THE

ELECTRICAL REVIEW.

VOL. LVII. OCTOBER 13, 1905. No. 1,455.

ELECTRICAL REVIEW.

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	Page
The Turning of the Worm	569
The Olympia Electrical Exhibition (*illus.*) (*continued*)	571
Correspondence	577
Lancashire Electric Power Supply	581
Business Notes	582
Hastings Electric Tramways (*illus.*)	589
City Notes	599
Stocks and Shares	600
Share List of Electrical Companies	601
Electric Tramway and Railway Traffic Returns	602
Belt Coal Conveyors (*illus.*)	603
Notes on the Selection of Incandescent Lamps	604
Reviews	606
New Electrical Devices, Fittings and Plant (*illus.*) (*continued*)	607
The Labour Dispute in the Berlin Electrical Industry	611
Efficiency of Steam Generating Apparatus	611
Our Legal Query Column	612
New Patents Applied For	612
Published Specifications	612

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THE TURNING OF THE WORM.

WE have always shared in the belief that the worm will turn, and we are not surprised, therefore, at the latest exhibition of gyratory gymnastics on the part of the glow worm.

As we had anticipated, the gas people have not been slow to make the most of their temporary triumph in the City.

The morning papers on Tuesday and Wednesday of last week fairly smelt of gas. If one might be allowed to criticise the excellent paragraphs which appeared, it would be to suggest that there was a rather noticeable lack of originality in the wording. They nearly all mentioned the name of Mr. Goodenough, the representative of the Gas, Light and Coke Co., who, by the way, must have had rather a busy time of it in the neighbourhood of Fleet Street, quite apart from any duties he may have had to perform in connection with the high pressure gas lamps.

All the paragraphs in question made a great point of the statement that the pressure of gas in these new lamps is four or five times that which is meted out to an ordinary consumer. This seems rather unfair to a poor inoffensive street lamp.

As we went into the various arguments as to the relative advantages of gas and electricity for public lighting somewhat exhaustively last week, we need hardly enter into the details of what is now put forward in these apparently inspired articles in the daily Press.

We need only refer our readers to the extracts given by us in our last issue of reports on this subject, in order to refute the statements attributed to Mr. Goodenough. This gentleman gives figures in the *Financial Times* and other papers, to show that the 34 new gas lamps in Fleet Street give "an effective light of over 5,000 C.P. near the pavement level, at a cost of £207 a year, in lieu of 12 arc lamps giving 6,000 C.P. in the heavens at a cost of £312 a year." Assuming that these figures are correct, we ask once more: Is it fair to make a comparison between the best modern gas lamps with brand new mantles, and old-fashioned arc lamps in obsolete lanterns, charged at a yearly cost which was open to revision?

The annual charge for electric lighting was about 25 per cent. more than is charged for arcs in most places, and no doubt if the opportunity had been given, the prices would have been reduced.

These prices, it should be remembered, included supplying arcs and lanterns, &c., whereas the cost of the new gas installation is being borne by the City authorities. Reduce this figure by 25 per cent. and double the candle-power by substituting modern lamps and lanterns, and what will Mr. Goodenough's figures look like then?

The *City Press* of October 4th makes the following statement with regard to the new gas lamp:—"One great advantage is that it diffuses a bright white light, and produces no heavy shadow like that inevitable with the electric

current." What arrant nonsense! What connection is there between the electric current and shadows?

True, a powerful light in a closed lantern throws shadows of the framework and base, &c., and if the gas light were as powerful, of course the shadows would be as strong.

It is unnecessary to argue against such statements, as to any man of average intelligence they carry their own refutation; but newspaper articles of this kind are often only half read, and the busy man goes away with the ideas they are intended to convey, without any very definite idea of the basis on which he forms his opinions.

The Dublin Alliance Gas Co. held a half-yearly meeting a fortnight ago and fairly gloated over the action of the City authorities.

The chairman, after describing electricity as "a present-day fad which is fast dying out" referred to the triumph of gas in the City. He spoke of electricity as follows: "After most conclusive tests, it has been proved that it cannot compete with gas for street lighting."

We challenge him to produce any evidence in support of either of these statements. Far from dying out, the returns of every electricity supply undertaking shows an enormous increase of lamps connected for the past year. What tests, we would ask him, can he find which prove that electricity cannot compete with gas for street lighting?

Science and Industry.

An article by Dr. R. T. Glazebrook, which appeared in the *Engineering Supplement of the Times* on September 27th, has this month called forth a fury of correspondence in that journal from professional engineers and chemists, complaining first of all of the nature of the work carried on at the National Physical Laboratory; and secondly, of the point of view from which the Director is thought by his critics to regard the value of the technical and scientific work of existing industrial concerns. As a rule, it may be taken as an axiom that no man, however great his qualifications, or however considerable his status, can afford to attack, or even make enemies, of a whole class of individuals. Dr. Glazebrook, with the best of motives, happens to have presented his case undiplomatically; with the result that the important fraternity of experts who, before the National Physical Laboratory came into being, carried out mechanical, chemical and electrical tests, and who still have a vast amount of such work entrusted to them, and, consequently, business to lose, have magnified their disabilities into a grievance. With equally good intentions he has drawn, or he is imagined by his critics to have drawn, an ill-considered comparison between experimentalists, such as he is able to secure for his services at the National Physical Laboratory, and the experienced technical advisers of the engineering and manufacturing firms of this country. He regards it as part of his mission in life to educate the employers. His argument is that no local laboratory can be successfully organised for research work, as questions may frequently involve expert knowledge in more than one subject; and he evidently regards his staff at Bushey, taken in conjunction with himself, as a superior combination, eminently fitted to undertake anything within the range of engineering, chemistry, or physics. This may be true, or it may not; it is a proposition requiring proof. The proof will be admitted when a trade-inspiring piece of research work is published from Bushey; whether right or wrong, the proposition and the article is as untimely as it is unnecessary. Our view is that the personal side of the question being as yet unproved, should be avoided by the Director; he should claim advantage not from himself, not from his staff, not even from the undoubted sympathy of the Royal Society, but from the assembly of instruments, the machinery, the general equipment, and the position of the laboratory. For he should remember that for every man he may select upon his staff for a particular branch of investigation, there are probably a hundred in the laboratories of industrial firms and towns who could give his man instruction. Indeed, it is difficult to imagine a branch of research in which he will not find it necessary to apply to outside technical men for advice; especially as a considerable part of the equipment at Bushey is designed and manufactured by these men. He should therefore avoid making foes of them. On the other hand, it is to be regretted that he personally should be attacked for carrying out tests which are obviously within the range of the original intentions of the founders of the National Physical Laboratory. It would be as futile to lay blame to Kew for examining clinical thermometers; or the Mint, the Admiralty, the Post Office, or the Ordnance Department, for making their own tests.

Electric Steel Smelting.

In a paper read by M. Gustave Gin, the well-known French electro-metallurgist, before the Metallurgical Section of the International Congress held at Liège last June, and now republished in a recent number of *L'Industrie Électrique*, the author draws special attention to an aspect of electric steel smelting that has, perhaps, not as yet received the attention it deserves, namely, employing the electric furnace as an *auxiliary* to the converter, much as in the Witkowitz, the Talbot-Martin, and other compound processes in which the converter eliminates the greater part of the impurities, leaving only the final refining operations to be carried on in a Martin furnace. For this final purification the electric furnace is in many circumstances pre-eminently suitable, on account of the high temperature that is readily available, the ease of control, the relative efficiency and the speed with which the operation can be carried out. M. Gín asserts that the time occupied by the auxiliary refining operation can be reduced to one-half, thus requiring a plant of only half the capacity for the same output if an electric furnace be substituted for the Martin furnace in any of the ordinary compound smelting processes.

Wanted—A Travelling Commission.

British metallurgists and electrical engineers generally, have been told on more occasions than one, in pretty forcible terms, that the only possible foundation for an electro-metallurgical or electro-chemical industry in Great Britain lies in the employment of the waste gases of blast furnaces; yet installations using these gases are few and far between, despite the fact that the pioneer work in regard to the matter has been done by English brains. We seem to need a travelling commission to visit the Continent and report upon the matter, a commission of metallurgists, mechanical engineers and electrical engineers. H.M. Consul-General at Berlin, in dealing with the condition of the German rolling mills, points out that the fruits of the present improvement in the iron trade have been reaped almost exclusively by "mixed works" which have their own blast furnaces, their own converters, and roll their own steel billets into rails or angle iron, all the stages of manufacture, from the receipt of the ore to, say, steel girders, being performed at one place.

Those German firms who are only rollers have been very hard hit, by reason of the price which they have to pay to the steel works syndicate for their raw materials. Indeed, it seems to be a case of a possible exit for the rolling mill pure and simple, except in the case of special small orders of high quality iron, for which higher prices are obtainable. An important factor in favour of the large mixed works has, according to the Consul-General, been the utilisation of blast furnace gas in internal combustion engines, it being stated

that sufficient gas for producing 5,000 to 6,000 H.P. is yielded by a furnace producing 200 tons of pig-iron per day. "The furnace thus acts as a generator plant supplying motor power for working pig-iron almost free of cost, and thereby becomes a powerful agent towards the further concentration of different stages of production within one works."

Quite apart from its purely metallurgical side, the question of the extended industrial use of blast furnace gas is of much importance. On this, according to such authorities as Mr. Harbord (who was one of the members of the Canadian Commission on the Electro-thermic Treatment of Iron Ores), depends the possibility of electro-metallurgical industries in this country. Beyond these, there seems to be an even wider field. Why should not a syndicate of furnace owners—say, in Cleveland, or in the Glasgow district—arrange to furnish to a central generating station a definite volume per diem of furnace gas, for conversion into electrical energy for traction and power purposes generally? The needs of their particular works might be met either by isolated generating plants or from the central station.

There is, of course, a rather widely spread view, from which gas engine builders dissent, that the gas engine has not yet reached a sufficiently high state of evolution to justify character in this country. Unless German and Belgian firms generally are doing rather more than burning their fingers in the matter, we are woefully behindhand in the United Kingdom in regard to the use of furnace gases in internal combustion engines. Why not, therefore, a select travelling commission to investigate the whole matter, the expenses of which might be borne by the four leading engineering institutions?

Sanitation by Electricity.

As we mentioned recently, a proposal has been brought forward by Dr. F. W. Alexander, medical officer of health to the Metropolitan Borough of Poplar, to the effect that electrolysed salt water shall be employed for disinfecting purposes in the borough. The proposal, in fact, is to revive the Hermite system, of which so much was heard about 11 years ago.

The process was actually adopted at various places in this country and abroad, and is still in use in Ipswich and at the Royal Victoria Hospital, Netley. In the former case the system is employed for disinfecting and deodorising the sewage of the town, while at Netley, we are informed, the fluid is supplied to the lavatory services and sanitary appliances throughout the Hospital, keeping them free from all objectionable smell.

The Hermite system was originally associated in this country with the name of Paterson & Cooper, and there is little room for doubt that it was one of the factors contributing to the dissolution of that once well-known firm; but it is important to remember that the catastrophe came about, not through the use of the system for sanitary purposes, but through its failure as a bleaching agent in paper manufacture, for which it was primarily intended. Hundreds of thousands of pounds were spent upon this project, with the most disastrous results.

On the other hand, there is no doubt whatever as to the efficiency of the electrolysed fluid as a powerful and quick-acting sterilising agent and deodoriser, and the only question in this connection is as to the cost of maintenance and working.

In Dr. Alexander's report no detailed estimate is given of the cost of adopting the Hermite process as compared with the existing system, but figures are put forward which indicate a very great saving, the cost of 440 gallons of disinfecting fluid (for materials and electrical energy) being given as only 11s. 1d. The cost of labour and capital charges are not dealt with, but probably these would amount to as much more, giving a total of, say, 22s. as compared with £15, the present outlay. It is not proposed, at present, to treat sewage, the intention being to distribute the fluid in bottles instead of the carbolic and other agents now in use.

There appears to be no reason for anticipating the failure of the process, as the system is neither new nor untried, and the progress of the proposal will be watched with interest.

Some years ago a similar, and probably identical, substance was on sale in bottles under the somewhat misleading name of "Electrozone."

THE OLYMPIA ELECTRICAL EXHIBITION.

(*Continued from page* 552.)

J. H. Tucker & Co.

Messrs. Tucker's specialities in the way of electric lighting accessories fill a good-sized stall at the Exhibition, and include all manner of well-made fittings, such as small switches, wall sockets,

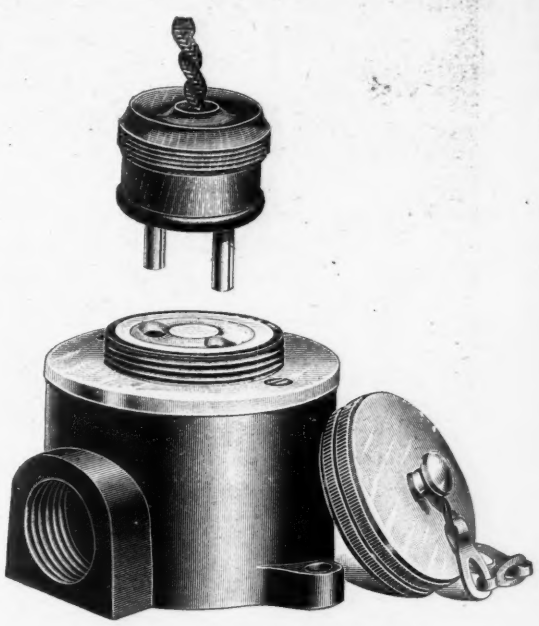


Fig. 53.—Watertight Wall Socket.

plugs, fuseboards and cut-outs, together with examples of heavier switches.

Of these we may specially mention the watertight wall sockets of the two-pin type (fig. 53). In these a china interior is fitted into a cast-iron box, the sockets being sunk in and isolated in the china.

A brass cap, with a rubber joint ring inside, is provided, which screws over the terminals and centre, effectually preventing moisture from entering. The case is tapped to take iron conduit.

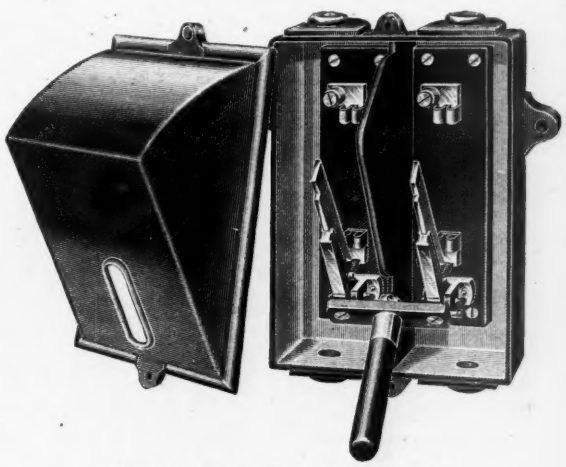


Fig. 54.—Standard Ironclad Switch.

Of the heavier switchwork, the firm's standard double-pole knife-switch enclosed in a cast-iron case is a typical example. The break is a long one, and independent of the handle movement.

The fittings are carried on a china base, the leading-in holes being fitted with insulating bushes, and an earthing terminal provided. This switch is designed for 500-volt requirements, and no one can quarrel with its workmanship.

Mountain & Gibson, Ltd.

Messrs. Mountain & Gibson's stand is devoted to tramway specialities, including radial and heavy railway motor-trucks (see Electrical Review for August 4th), trolleys, life-guards, brakes and other matters dear to the tramway man and not without interest to the visitor.

Marryat & Place.

The obvious difficulty of exhibiting an actual electrical installation at Olympia has been brilliantly circumvented by Messrs. Marryat & Place, who have one of the most popular shows in the building, consisting of two electric furnaces. One of these is of the

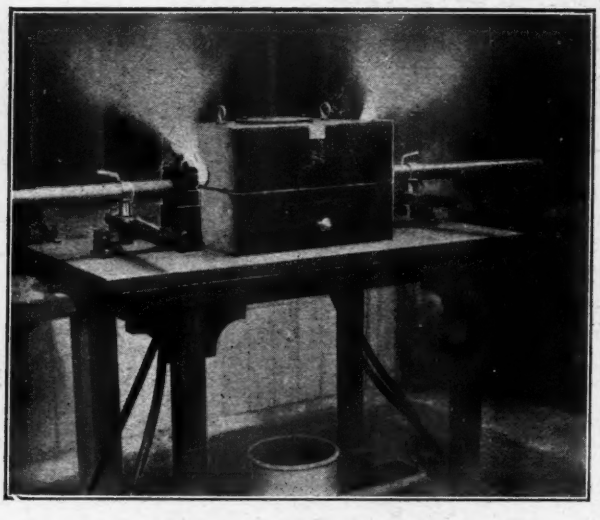


Fig. 55.—Moissan Laboratory Furnace.

Moissan laboratory type, capable of absorbing 250 H.P. at full load (1,000 amperes × 200 volts). The lining consists of magnesia and carbon, and is renewed daily. The electrodes are of round carbon, 2 in. × 36 in., and can be instantly separated up to a distance of 14 in. A feature of the furnace is the ellipsoidal roof cavity, which acts as a reflector, concentrating the heat rays from the arc on the crucible below. As in Moissan's classical experiments, the furnace, which we illustrate, is used for melting iron rod, which is introduced into one of the carbons as a loose core; the drops of molten iron fall through a hole in the bottom of the furnace into a bath of water and mercury, by which they are suddenly cooled, and the carbon absorbed by the iron in the arc, being subjected to enormous pressure whilst still at an extremely high temperature, crystallises out in the form of minute diamonds. The process, however, of isolating the latter is not carried out, the diamonds being taken on trust.

In conjunction with the operation of the Moissan furnace, the Féry radiation pyrometer is being used to measure the temperature of the interior. This instrument is made by the Cambridge Scientific Instrument Co. The firm also show an open arc two-pole furnace, suitable for raising 4-cwt. charges of iron to the necessary temperature for steel production. The exhibit is a model intended only to show the principle upon which the highest grades of tool steel are produced in existing installations. Messrs. Marryat and Place publish an interesting booklet on the Electric Furnace, copies of which may be obtained gratis in exchange for visiting or trade card.

A. Blackmore and the Birmingham Guild of Handicraft, Ltd.

"Far from the madding crowd," or to be more explicit, in the gallery of the Exhibition, can be seen a novelty in electrical installation work in the shape of Blackmore's dead wiring system, for which patents are pending. This is practically a remote control system applied on a small scale to house wiring.

A specially designed double-pole switch and fuseboard is fixed at the entrance of the supply mains; the switches are actuated by a powerful electro-magnet, which receives its excitation from the lighting mains through a local circuit. This magnet is actuated through a series of smaller relay magnets, worked from a battery at low potential; the controlling circuits for the individual relay magnets (and corresponding lighting circuits) run to the various rooms of the building, where ordinary bell push-es are used for closing them.

Thus in an ordinary way, when the lights are not in use, the whole of the lighting and wiring beyond the control board is dead, and fire risks, leakage, &c., are obviated; further, the lighting of one lamp only energises that particular circuit.

For staircase and corridor lighting the controlling pushes can be used in parallel for any number of positions, thus avoiding the ordinary complications of such cases. Master switches for controlling the whole or any section of the installation can also be arranged with indicators, if desired.

Those interested in large installations would do well to visit the stand, which is wired on this principle, with handsome fittings supplied by the Birmingham Guild of Handicraft, Ltd.

The fittings also are well worth inspection, if only to see the combination of artistic treatment with mechanical detail in construction, for which these makers have earned so excellent a reputation.

The Pyrophone Co.

If one could summarise the whole of the exhibits shown at Olympia, and devoted to fire protection, the result would be astonishingly comprehensive; much of the apparatus is, of course, non-automatic, and among the automatic devices the above com-

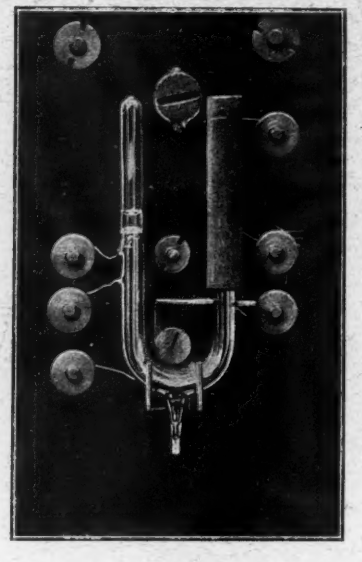


Fig. 56.—Pyrophone Differential Detector.

pany's apparatus is both novel and interesting. The Pyrophone gives, first of all, a "danger call," and then a "fire call"; it also gives a "trouble call" in the event of the system falling out of order. The latter feature is an important one, as a fire detecting apparatus out of order is a positive danger.

The detector consists of a differential and a fixed part; the former, which we illustrate, is in the form of a closed glass tube, half filled with mercury, on the top of which is a liquid with a low boiling point. One branch of the tube is covered with insulating material; two platinum wires enter the non-insulated branch, and one leads from the insulated branch of the detector tube.

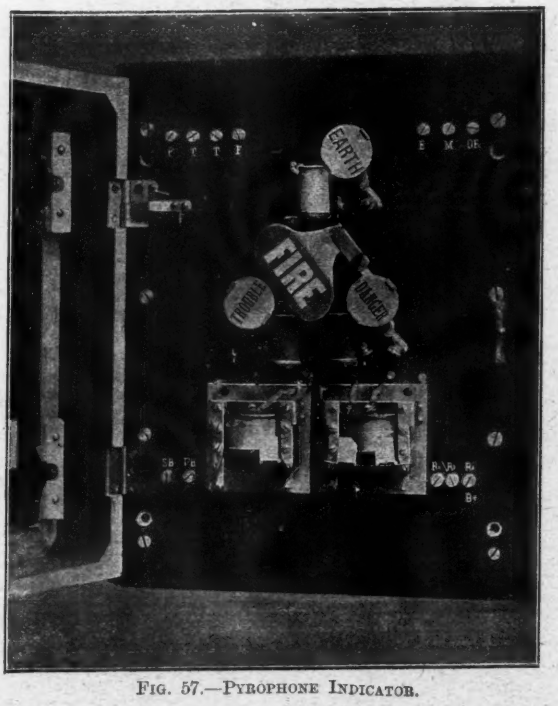


Fig. 57.—Pyrophone Indicator.

The apparatus works on the closed-circuit system, and a sudden rise in temperature causes the volatile liquid to evaporate, driving down the mercury below the first wire, breaking that circuit and giving a "danger" call; a continued rise in temperature causes the mercury to fall below the second wire, breaking that circuit and giving a "fire" alarm.

The fixed portion of the detector is of very similar construction, but the entering and leaving wires are somewhat differently

arranged; it also gives a "danger" and "fire" call. The differential and fixed parts are connected in series with the indicator apparatus, and are mounted on a porcelain base covered by a screen, the full size of the detector being 4½ in. × 3 in.

Our second illustration is of the indicator apparatus, where will be seen two relays mounted on the lower portion. The right-hand relay has two armatures, one of which drops on the breaking of the auxiliary danger circuit, and the second on the complete severance of the circuit at the second wire, when a fire call is given. If, through mechanical causes, a complete break occurs in the circuit, a local circuit is arranged to drop a "trouble" indicator instead of the "fire" call. At the moment when either of the above three calls is given an auxiliary "group" indicator falls, showing the exact locality of the trouble or fire. Similarly, "earth" and "battery" indicators fall in the event of failure in those directions; the "battery" and "group" indicators, however, are not shown in our illustration of the indicator.

The fire call is accompanied by the ringing of a loud-toned bell, while for other calls a semi-toned bell rings.

The indicator board illustrated is for one group of detectors, and it can be extended downward for any number of groups. This system has only recently been taken up in England by the Pyrophone Co., of 52, Queen Victoria Street, E.C.

G. Braulik.

Mr. G. Braulik, of Upper Thames Street, E.C., has two stands, one in the central avenue, and the other under the gallery. Both of them have material enough on view to occupy and interest the visitor for many hours. The one under the gallery shows a Hillenbrand suction gas engine running. The working of this engine is similar to that of the ordinary modern suction gas plant. The gas for driving the engine is obtained from a current of atmospheric air saturated with steam, which is drawn through a layer of incandescent anthracite. The newly made gas is cleaned in the scrubber and mixed with air before entering the combustion chamber of the engine, where it

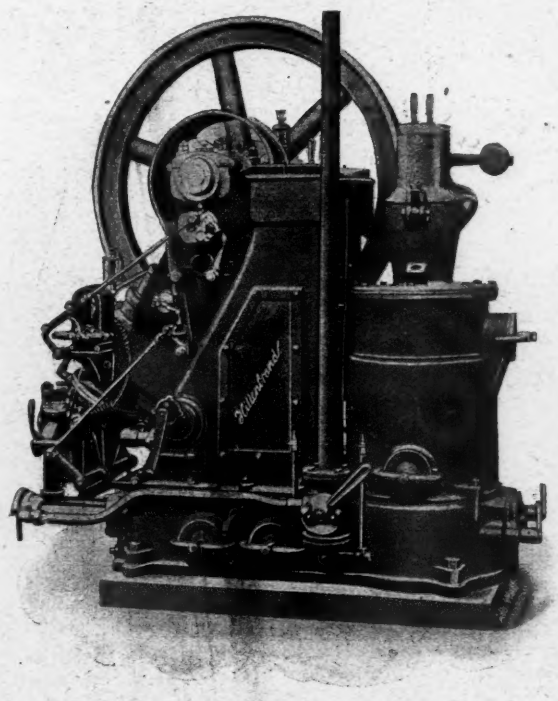


Fig. 58.—Hillenbrand Suction Gas Engine.

is ignited in the cylinder by means of an electric spark. The engine works on the well-known "Otto" cycle. The cylinder is in a sloping position, but the valves are placed vertically. For electric power purposes the engine is supplied with an extra heavy fly-wheel, giving greater uniformity of motion. Owing to the compact construction of the plant, the gas generator, scrubber and engine itself being all combined in one, the space occupied by the plant is very small. By a special cooling process the consumption of cooling water in the water jacket is reduced to from a quarter to a fifth of the quantity necessary in other makes, which further reduces the cost of running. The different parts of the plant being close to each other, junctions with larger sectional areas can be used, increasing the efficiency of the engine. The plant shown is rated at 5 B.H.P., and with it, it is said that the cost of fuel for 10 hours continuous working at full load is about 6d. per day. Coupled to a dynamo it will light 50 16-c.p. lamps.

Mr. Braulik had at the same stand a demonstration of Kryptol—his new resistance material for electric heating, which is being applied to hot plates, combustion, crucible and muffle furnaces, drying ovens, &c. Wienert arc lamps, including a "flame" type, photographic arc lamps with time limit attachment and portable electric drills, were among the other exhibits. At the other stand there is a great variety of electric measuring, telephone, fire alarm bell and similar apparatus, innumerable electric light fittings, electric clocks, and so on, which we unfortunately cannot here particularise.

The Western Electric Co.

The Western Electric Co. has earned for itself a reputation second to none in telephone work, a fact which an inspection of the telephone section of the company's stand makes clear. The exhibits of this department include telephones for the house and the office, for tramways and railways, for mining and military purposes, for fire brigades and police patrol stations, in fact, telephones for all conceivable purposes; these are again adapted for use in connection with this company's "central battery" system or the older "magneto" and "battery call" systems. It is, of course, impossible in the short space at our disposal to do more than briefly describe the most novel features of the exhibit.

A novel instrument is that known as the No. 2 Private Branch Exchange. This is a "central battery" intercommunication system arranged so that any pre-arranged number of the local stations may be put, when desired, in connection with the exchange line. Connection is made without the intervention of an operator by the

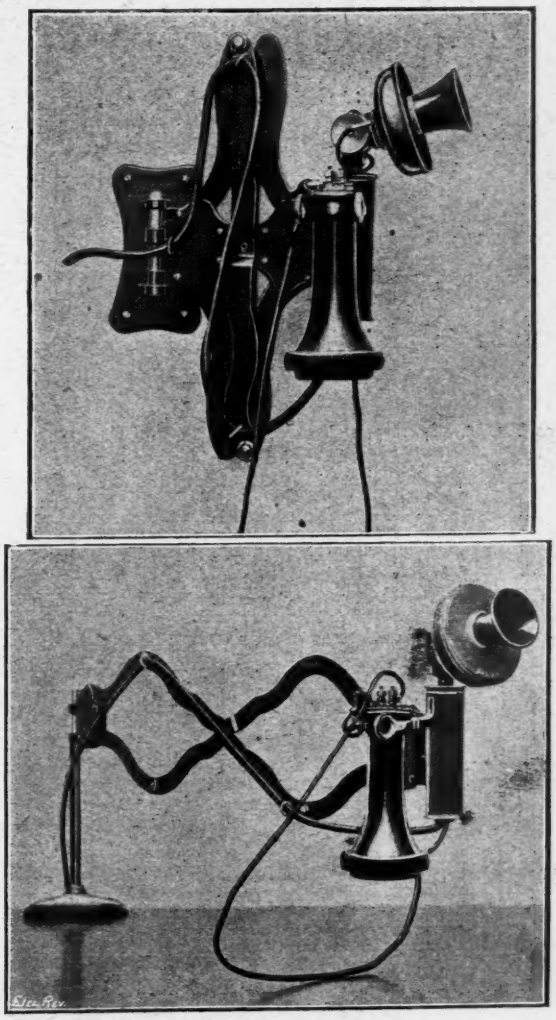


Fig. 59.—Folding Telephone: Western Electric Co.

simple method of depressing a key, which remains locked down until another connection is desired. The economy of this system and the uses to which it may be put are obvious.

The fire alarm boxes shown are arranged to repeat automatically the number of the station in "Morse code" to the fire station, where it is received on a "Morse inker." A Morse tapper is provided for sending messages when testing the line or inspecting the instruments, and a jack is provided so that a portable telephone may be connected at once with the line, for giving reports to the station, or ordering up more engines, as the case may be. The door is provided with a handle which, as soon as it is turned to open the door, actuates a loud sounding gong to attract the attention of the policeman on point duty, so as to prevent the box being fraudulently used.

The telephones for railway use are known as "composite sets," and are arranged for sending messages both telegraphically and

telephonically. They are designed for carrying in the "brake van" of special trains, so that in case of necessity communication can be at once established with the nearest office. The set is complete with a bamboo pole about 18 ft. long. (made in three sections for convenient transportation) for "tapping" the telegraph or telephone lines. A small model common battery switchboard serves to illustrate a central telephone office equipment; the energy for operating it, as in the case of all common battery exchanges, is generated by one of the firm's special telephone motor-generators (fig. 60), which differ from ordinary lighting machines in the arrangement of their armatures and commutators; the armature is "form" wound and the commutator is arranged with a large number of segments to eliminate the noise caused by "commutation" of the current. The ringing currents used in connection with telephone exchanges are generated by the "Ringing Dynamotor" mounted at the end of the motor-generator.

Numerous examples of wall pattern magneto switches, cordless switchboards, annunciators, burglar alarms and allied material are on view. The large collection of rolled condensers for all purposes and of all sizes and capacities, and a neat little annunciator known as the Dandy register, for indicating at the office whether the various tenants in a flat or mansion are "in" or "out," are items of special interest.

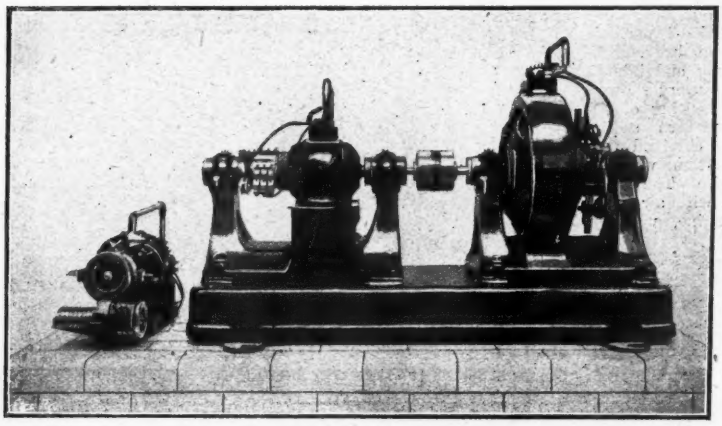


FIG. 60.—TELEPHONE MOTOR-GENERATOR AND RINGER: WESTERN ELECTRIC CO.

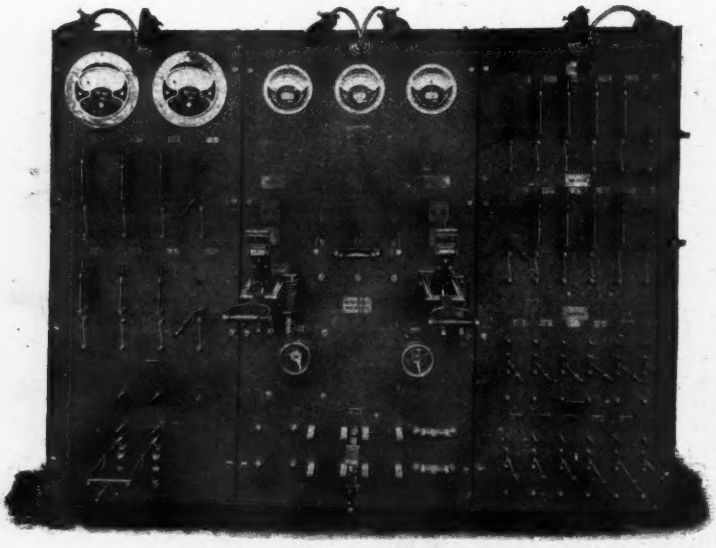


FIG. 61.—POWER SWITCHBOARD: WESTERN ELECTRIC CO.

As representative of the work of the other departments of the firm, a switchboard (fig. 61) has been erected, which deals with both the alternating and continuous current supplied for working the lights, motors, ceiling fans, &c., on the stand.

A popular attraction is a motor-driven sewing machine, with a friction drive; the pressure of the foot upon the treadle gradually turns the body of the motor round, so that the driving wheel of the sewing machine comes into contact with the larger periphery of the friction wheel, resulting in a corresponding increase in speed. In this manner any variation of the speed (within certain limits) can be obtained. The removal of the foot from the treadle causes the motor to assume its normal position, and automatically applies a brake to the driving wheel of the sewing machine, arresting its motion instantaneously. The company's cable department is also well represented on the stand.

The Sterling Telephone and Electric Co.

Under its new title, this, our old friend the Berliner Telephone Manufacturing Co., provides one of the most complete telephone exhibits to be found at Olympia. Telephones, switchboards, electric bells, indicators, bell pushes, fire alarms, &c., in numerous patterns and for every purpose, are on view; many of them being novelties, are of special interest.

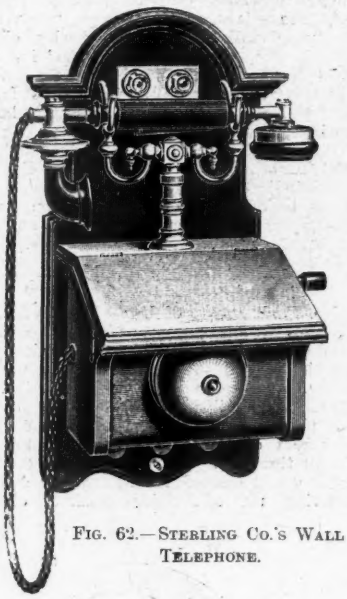


FIG. 62.—STERLING CO.'S WALL TELEPHONE.

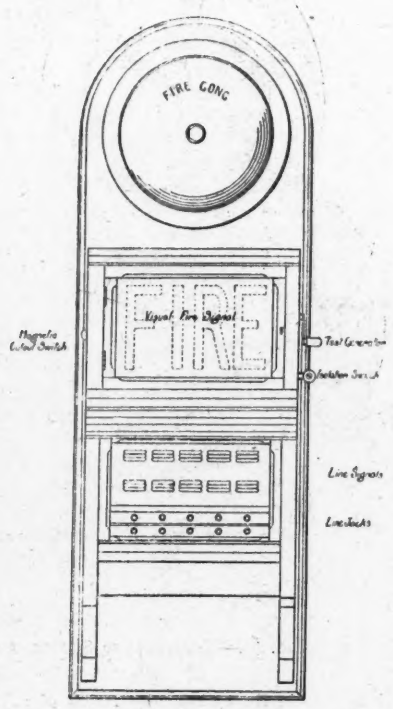


FIG. 63.—STERLING CO.'S FIRE ALARM BOARD.

The Parlyphone and "Twencen" domestic telephones are handy little instruments for attaching to ordinary bell circuits. The "Hygienea," the pioneer of hygienic hand-combination instruments, which was described in the ELECTRICAL REVIEW of Sept. 25th, 1905, and which, in dispensing with the mouthpiece, marks a step in advance from this point of view, figures very prominently, and is well worth inspection. The up-to-date "Sterling" patent intercommunication telephones, and the excellent exhibit of portable military and rifle range instruments will also claim the attention of the visitor.

Many examples of telephone switchboards are on view, in which the latest improvements are incorporated; a particularly interesting pattern is the combination table switchboard, constructed in the form of a secretaire, and arranged for the operator to carry

on current work at the desk, in addition to attending to the telephone.

In one pattern a typewriting machine is fitted, the operator being also provided with a head-dress outfit, so that she can receive and take down all letters through the telephone. The machine is mounted on a disappearing platform, which envelops it when not in use.

Among the numerous fire alarm devices on view, the "Sterling" combined telephone and fire alarm system is specially noteworthy.

Fig. 64.—Combination Secretaire-Switchboard.

This system is adopted for use in large public buildings, where by the addition of a common return wire to an existing "Sterling" central battery telephone system, the lines, annunciator and battery can be used for the fire alarms.

The central station equipment includes an operator's telephone (fig. 62), and a central battery switchboard, with a visual fire signal, electro-magnetic cut-off switch, testing generator and alarm bell (fig. 63). The latter can be replaced by a number of scattered bells arranged to ring simultaneously. An alarm can be immediately localised on the telephone switchboard, and a means for discriminating between telephone and fire calls which occur simultaneously, is provided.

This arrangement provides an obvious economy in wiring and apparatus, and owing to the telephones being more or less always in use, any failure or breakdown would be easily discerned.

A noteworthy exhibit is part of the exceedingly elaborate fire alarm apparatus which is to be installed at the Ritz Hotel, including an ingenious patent alarm box, which gives the alarm on the glass being broken, but can be opened for inspection without giving an alarm. For particulars of this apparatus we must refer the reader to the exhibitors.

Union Electric Co., Ltd.

The Union Electric Co. provides an attractive display of the four classes of apparatus in which it specialises, viz., dynamos and motors, arc lamps, switchgear and measuring instruments. The

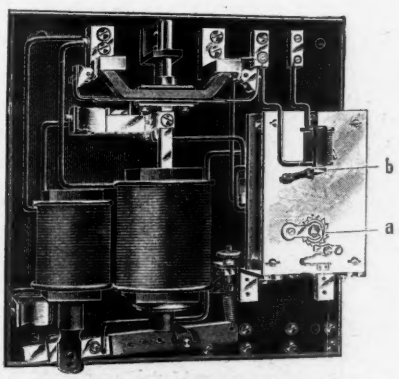


Fig. 65.—Union Co.'s Remote Control Switch.

various examples of D.C. and three-phase A.C. motors on view and working, are representative of machines supplied by the company, which range up to 1,400 KW. in standard designs.

Union arc lighting is prominent in many directions; both outside and inside the Exhibition hall, the Excello arc lamp can be very much seen in operation. These lamps run four in series on 220-volt circuits; the mean hemispherical candle-power of each is 3,300 and the burning hours 18.

The firm's arc lamps are also utilised in lighting numerous stalls in the Exhibition, including, of course, the makers' own stand, where their number and diversity of pattern and purpose cannot fail to strike the visitor. Special mention may be made of the two monster "Excello" arc lamps burning at this stall, which are rated at a m.h. candle-power of 20,000.

The switchgear on the stand, is adapted for both H.T. and L.T. working, the latter type of apparatus covering a range up to 6,000 amperes. The switches are all provided with special breaking

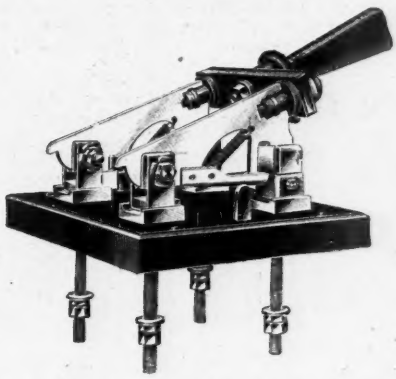


Fig. 66.—Union Co.'s Double-Pole Knife Switch.

devices, either in the form of a quick motion finger or a magnetic blow-out. The H.T. switchgear on view, is designed to deal with pressures up to 12,000 volts.

We illustrate a remote control switch, which the firm supplies for switching on or off, one or more circuits at a distance, by means of either a high or low voltage operating circuit. The essential

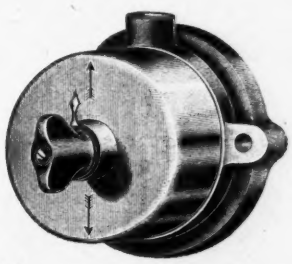


Fig. 67.—Automatic Interval Switch.

parts of the switch are a quick make and break switch, controlled by spring mechanism, and worked through a solenoid and plunger by a small auxiliary operating current. The operating circuit can be closed by means of a contact clock or a contact maker.

An interval switch, for automatically switching off at a given interval of time after switching on, the lighting of cellars, staircases, corridors, &c., and places likely to escape attention, is illustrated in fig. 67.

W. & T. Avery, Ltd.

The principal item on Messrs. W. & T. Avery's stand is the "Avery" patent automatic weighbridge, which automatically adds up the net weights and records them on a dial, also counting the number of truck loads passing over the machine. Skilled labour is thus done away with. The weight of each load can be separately indicated, if desired. Obviously all the trucks must have the same fixed tare weight, to which the machine is balanced, so as to record only the net weights.

Another interesting exhibit is Avery's patent impact testing machine, by means of which the capability of any material to withstand shock can be determined. In this machine a pendulum weight is raised to a given height, and is allowed to swing and strike the test piece; the latter is fractured in one blow, and the number of foot-pounds of energy absorbed in the process is automatically indicated on a scale.

The firm's well-known standard automatic weighing machine for coal is also shown in operation.

Drake & Gorham, Ltd.

The exhibit of Messrs. Drake & Gorham—accommodated on no fewer than five of the allotments designated as "stands"—is of a varied character, ranging from a suction gas plant to a "real elegant," dining table, and from the Phillips commutator grinder to an electric sewing machine. The gas producer is of the Dowson type, and is driving a gas-dynamo of 8 KW. Pumping, churning, cream-separating, horse-clipping and chaff-cutting machines are shown, driven by electricity, and the Holden magnetic clutch is in operation in connection with one of them. New types of Jandus lamps are used to light one of the stands, while various patterns of

Nernst lamps, and a bank of tantalum lamps, are exhibited. An oil engine, a push button lift, a standard switchboard, and a highly artistic display of decorative fittings, are included in the exhibit, which is well calculated to interest and enlighten the owners of country houses, of which Messrs. Drake & Gorham have fitted up so many, as well as other classes of consumer.

Exhibition Power Plant.

Exclusive of the outside supply of energy to the Exhibition, which is on the alternating system, a steam dynamo has been installed for supplying direct current to those exhibitors who may want it, and this is the only steam-driven generator running on load in the hall. The engine is one of Messrs. Davey, Paxman's well-known "Peache" type, a three-crank compound, capable of developing

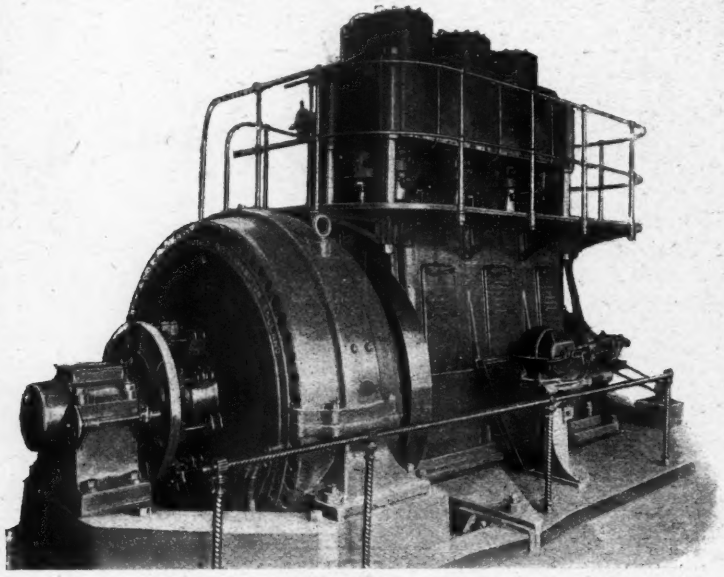


Fig. 68.—Peache-Parker Steam Dynamo.

440-500 h.p. on normal load, when running at 325 r.p.m. The diameters of the cylinders are 11 in. and 22 in., with a stroke of 12 in. The generator is of Messrs. Thomas Parker's make, direct coupled to the engine. It is a 10-pole machine with an output of 1,150 amperes at 250 volts.

Both the engine and generator were assembled in the Exhibition for the first time, and ran under steam on the first and succeeding nights without a hitch—a performance upon which both firms are to be congratulated.

Brockie-Pell Arc Lamps.

The stand of the Brockie-Pell Arc Lamp, Ltd., is brilliant with the rays shed by a large number of the company's lamps, which maintain the high reputation so long held by them. No special novelty is shown, but the company is making both open and

Fig. 69.—Single Enclosed "Brochipel" Arc Lamp.

enclosed types, under the direct supervision of Mr. Brockie, in various styles. We illustrate one of their single enclosed lamps, with ornamental copper case.

James Dickson.

A full collection of dynamo and motor brush specialities—the "Tieciton"—which are employed in many electricity supply works in London and the provinces, is displayed by Mr. James Dickson, of 48, Gray's Inn Road, W.C., who also shows wire guards for electric lamps, and wire frames for lamp shades. The firm specialises in wove wire gauze in all metals, meshes and strengths.

Le Carbone.

A great variety of carbon brushes is shown by Le Carbone, as well as hard refractory carbon blocks for switchgear, lightning arresters, resistances, &c. Primary batteries of numerous patterns are also exhibited, and carbon trolley wheel bushes, for which a long life is claimed.

D. Santoni & Co., Ltd.

A large variety of the firm's well-known intense flame arc lamps, in various patterns and sizes, and for both alternating and direct-

Fig. 70.—Santoni Flame Arc Lamp.

current, are prominent at this stand; and together with the numerous specialities in the way of fittings, bells, instruments, carbon blocks and insulating varnishes are well worth inspection.

Armorduct Manufacturing Co., Ltd.

At the stand of the Armorduct Co. there is a large assortment of conduits and fittings of various types, showing successive stages of manufacture, and a variety of junction boxes adapted for requirements of all kinds—flush, knock-out, screwed, slip-joint, &c.—including malleable fittings squashed flat, to show the ductility of the metal. A new form of "knock-out" junction box for close-joint tubing is of special interest, and is illustrated herewith (fig. 72); in this pattern the "knock-outs" are placed about ½ in. from the external opening to allow room for the end of the tube. Wires and cables and insulating materials are also shown in various stages of manufacture. A ¾-in. welded tube bent cold many times round a cone measuring only 2 in. in diameter at the

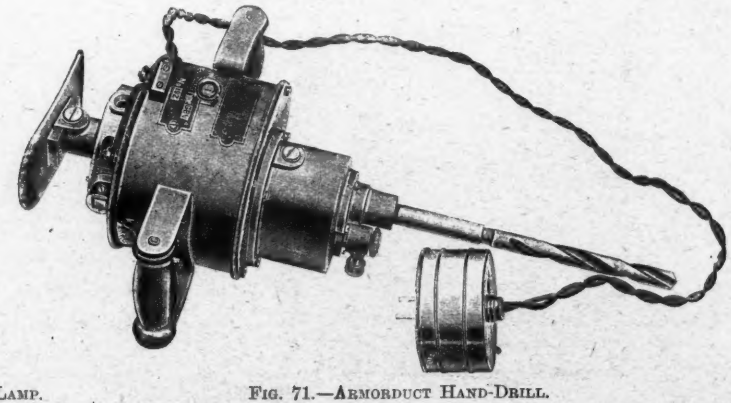


Fig. 71.—Armorduct Hand-Drill.

apex, without flattening or cracking, illustrates the quality of this material. A neat little hand drill, consisting of a ⅛-h.p. motor geared to a Morse drill, is exhibited; this weighs only 9 lb., and drills holes of any diameter up to ⅝ in. It has three speeds, ranging from 835 to 1,730 r.p.m., the speed variation being produced entirely by gearing contained in the case, and running in oil. The magnet is of steel, and the non-magnetic parts of aluminium alloy. In the plug is an ingenious little overload cut-out, which

also indicates when the limiting load is about reached. Another novelty is the "Blaze" flame arc lamp, with differential control, and a device for cutting out the shunt coil when the carbons are

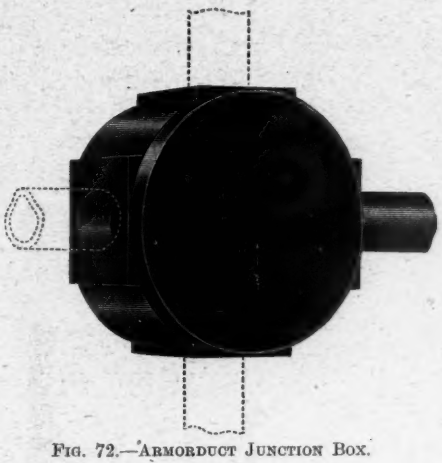


Fig. 72.—Armorduct Junction Box.

burnt out. The construction is simple, and the parts inside the lamp are nickel-plated to prevent corrosion. These lamps burn well four in series on 220 volts.

Callender's Cable and Construction Co., Ltd.

Messrs. Callender's have erected a model colliery pit road, to show how their patent cable clips are used, and a shaft, to illustrate how their casing is installed. Their vulcanised bitumen insulated

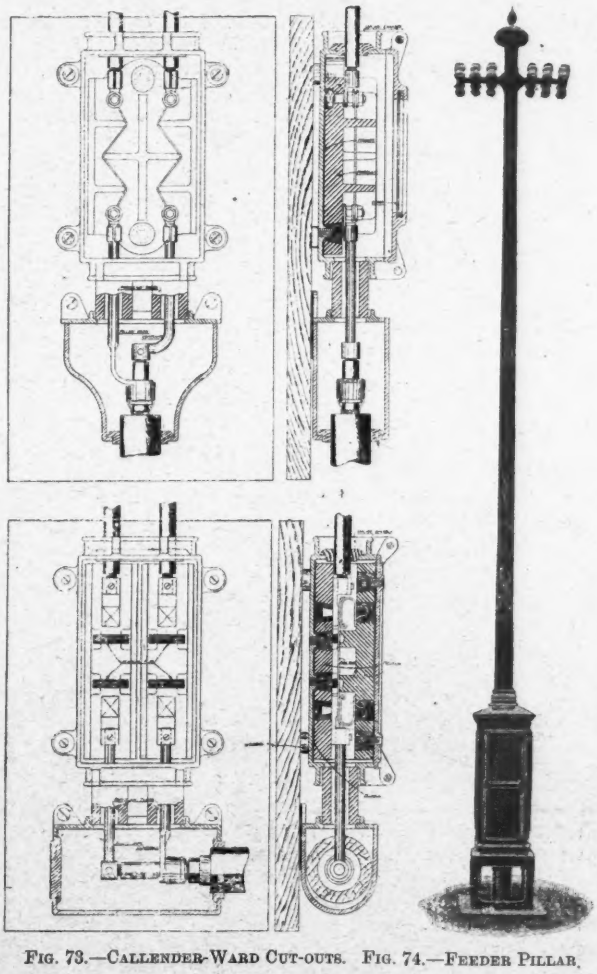


Fig. 73.—Callender-Ward Cut-outs. Fig. 74.—Feeder Pillar.

cable is specially suitable for colliery work, being light and incorrodible. Samples of all their rubber, bitumen, fibre and paper-insulated cables are shown, with numerous joint and disconnecting boxes, feeder pillars on their new double insulation system (already described in our articles on the Tramways Exhibition), and cut-outs. One feeder pillar we illustrate (fig. 74); this is intended for Tucuman, South America, and provides for feeding four overhead circuits. It will be seen that the pole passes right through the pillar, which is otherwise equipped on the same principle as their ordinary pillars. The whole of Messrs. Callender's cut-outs have been restandardised;

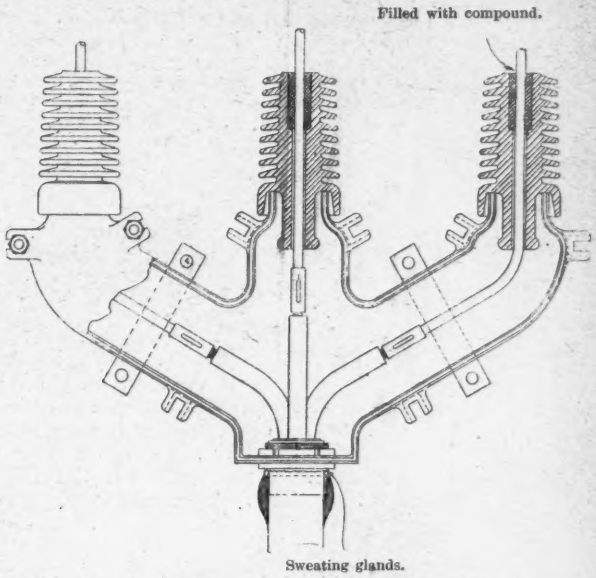


Fig. 75.—Extra High Tension Dividing Box.

we illustrate two of them, one of which explains itself, whilst the other is so arranged that the wire itself, held in spring lugs, is pressed against the terminals, without the aid of any screws, and can be renewed when the box is opened without the slightest danger of shock. It also acts as a switch. The remaining illustration, fig. 75, shows an extra high-tension dividing box, which is filled with bitumen compound, and is suitable for connecting overhead with underground mains. The whole exhibit is worthy of close examination.

(*To be continued.*)

CORRESPONDENCE.

Letters received after first post on Wednesday morning cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Electro-Deposition of Copper.

My attention has been called to Mr. Harry Ellis's letter in your issue of October 6th. I have always understood that at the works at Schladern-on-the-Sieg the Elmore process has been greatly modified, and that the smaller sized tubes are made by a process of casting and drawing, and are not electro-deposited and burnished by the Elmore process. I shall therefore be glad to learn from Mr. Ellis if all the tubes he refers to are made entirely by the Elmore burnishing process.

Sherard Cowper-Coles.

Westminster, *October 7th*, 1905.

Electrical Exhibition.

I notice in your present issue, dated October 6th, that you state you have a complaint to make with somebody, and mention the Hammersmith Borough Council Electricity Department.

You mention as a fact that the demonstration of electric cooking was unable to be carried out owing to the lack of current for this purpose. I am sorry you have made this statement without first ascertaining the facts of the case, and had you made application to anyone in authority you would have been informed that it was not the lack of current which prevented the demonstration being carried out. As a matter of fact, there are three mains serving the lecture room, and full pressure was maintained on all these mains the whole time, so the supply was available for immediate use.

You mention also that this is not the only complaint

about the supply of electricity. If you make inquiries you will find that if anyone has been unable to obtain a supply, it is entirely due to their neglecting to order same. A great many exhibitors did not make up their minds until a day or so before the exhibition; in fact, the Saturday before the opening I found it necessary to order no fewer than six dozen more meters and fuse boxes. This in spite of the exhibitors being continually circularised asking for full particulars of the supply they would require, so that I could make suitable arrangements for connecting up.

I trust that you will take an early opportunity of withdrawing the statements made, as upon inquiry you will find them to be erroneous.

G. G. Bell,
Engineer and Manager.

Hammersmith Electricity Department,
October 6th, 1905.

[On Monday, October 2nd, a message was received at this office inviting us to attend at Olympia at a demonstration of electric cooking at noon. We laid aside other pressing matters and went. But when we arrived there could be no demonstration because the arrangements were not completed for supplying current to the apparatus. We have since read somewhere that the switchboard was not completed. Then why were the invitations issued? Surely we had reason to make complaint "against somebody" under such circumstances! Mr. Bell has disclaimed all responsibility, and we are content so far as his department is concerned to accept his statement.—Eds. E.R.]

Booth's Circus.

With reference to your note dealing with the system of circus arrangement of cross-road traffic, as advocated by Mr. Booth, it may be of interest to some of your readers to know that a similar method was tried and discarded on the South London Tramways, at one of the large crossings, about 30 years ago.

W. H. Johnson.

Kentish Town, N.W.
October 9th, 1905.

Starting Steam Turbines, and Afterwards.

I have read "Britisher's" reply to my letter, and note that he states that when the shrouded blades come into contact with the outer case, only one shroud is affected. Surely, if one comes into contact, it must wear itself down and allow another to meet the same trouble next time.

There is no doubt that a steam turbine can be made to give a good initial steam efficiency. But what happens inside after the turbine has been started is, I consider, of still greater importance. One would think that if the blades were fixed in a mechanical manner it would be impossible for them to become completely stripped, shrouding or no shrouding.

I wonder whether "Britisher" has ever considered the loss of steam through the dummy piston rings in a parallel flow turbine altogether apart from the leakage between the blade clearances? The live steam wasted for balancing purposes alone becomes an alarming quantity as the faces of the dummy rings grind away. Moreover, has "Britisher" considered the pitting effects of the steam which also tends to assist the wearing away of metallic surfaces?

It seems to me that "Britisher" will admit there is faulty design somewhere in the turbine he champions, and it should set "Britisher" and other makers of turbines seriously thinking how to enhance the reputation of a British industry instead of prophesying the discomfiture and chagrin of any one who dares to presume to keep out of a well-worn rut, prescribing one unparalleled flow of mechanical difficulties.

No, sir. The present design of turbines made in this country must be altered, so as to enable the clearances to be taken up and adjusted (preferably on a flat surface and not on diameter, as in the modern practice).

The turbines mentioned by Eds. E.R. are "impulse" turbines, and the action is entirely different from that of the Parsons and Willans.

Greaser.

"Hygienic" Telephones.

We were greatly amused at the article which appeared in the *Evening Standard* of the 6th inst. under the heading of "Hygienic Telephones." In this we were told that for some time past the G.E.C. have been experimenting with a view to producing a telephone which would overcome the objection of an instrument capable of harbouring the germs of disease, and that, as a result of their meritorious labours, they have produced, and are now exhibiting in their private office at their stand at Olympia, one pair of their new "Hygienic" telephones.

Now let us see how long this enterprising firm have been experimenting in the direction above stated. To one Press representative, at least, a G.E.C. official stated that their attention was only attracted to the subject by the correspondence in the papers on insanitary telephones, and that they then put their heads together and produced this pair of "hygienic" telephones. Since the correspondence having reference to the question only appeared in the papers some 12 days ago, we may place the duration of experimental research at the same period. Is this what one would call experimenting for some time past? How delightfully naive are the G.E.C.! From the articles in the *Evening Standard* and the *Daily News*, the public are distinctly led to believe that they (the G.E.C.) are the first to present an "hygienic" telephone. They certainly make an obvious attempt to take the kudos unto themselves, which, considering all the circumstances hereinafter mentioned, is, to say the least of it . . . Well, there! Bluff is all very well, but I think the G.E.C. go too far, and much as I find it distasteful, I am obliged to place it on record that they have no tittle of claim to the place of honour which they would occupy as being the first firm to offer an "hygienic" telephone to the public.

For weeks past my firm have extensively advertised and offered for sale the "Hygienia" telephone, which we unhesitatingly say is the first hygienic instrument ever offered to the British public. If numbers go for anything, we may inform you that we have already manufactured nearly 10,000, the greater portion of which are sold for delivery. The G.E.C. cannot fail to have seen our advertisements in the electrical Press, and also a large number of the actual instruments on our stand at Olympia. If, therefore, they have now decided to bring out a competitor to the "Hygienia," why don't they "play the game," and go about it in an orthodox manner, instead of taking such an extraordinary and quite unusual course.

The Sterling Telephone and Electric Co.,
Late the Berliner Telephone Manufacturing Co.,
J. B. Birnbaum, *Manager.*

London, E.C., *October 10th*, 1905.

The All-Steel Railway Carriage.

Your correspondent "Experience" must be an old gentleman with a wonderful memory to recall so vividly the terrible discomforts of steel railway carriages 50 years ago. Of the hundreds of thousands of people who have travelled on Mr. Cuningham's steel cars on the Central London Railway during the past two years, not one has complained of being frost-bitten in winter or parboiled in summer. In fact, I do not suppose they even knew that the cars were steel.

I must confess that until I read "Experience's" letter I did not know that the manufacture of steel was so far advanced 50 years ago that railway cars could be made of it.

No doubt the Brush Co. would be very much obliged to "Experience" if he would produce some record of the steel

cars of 50 years ago; but, failing that, the company is not likely to be turned from its course in pushing the sale of rolling stock which both English and American practice of the present day shows to be in demand.

T. C. E.

A Personal Statement.

I notice in last week's issue of the ELECTRICAL REVIEW my name mentioned in the "Personal" column.—"Mr. Butler has resigned the position of station engineer at the Dartford U.D.C.'s Electricity Works . . . . the salary is £100 per year, with house, fuel and light." That looks very nice in print. I was appointed here as fitter-driver at 30s. per week and 8d. an hour overtime on November 25th, 1901; then on July 31st, 1902, I was made works' foreman, with a 5s. rise, to supervise the extensions and the men's work, maintenance of engines, boilers, pipe-work, &c., and also to take charge of the shift from 3 p.m. to 11 p.m., and do the driving. I was asked by the chief to come and live in this cottage in December, 1903; I agreed on condition that my wages were not reduced, but as we had to work overtime through insufficient staff, my overtime, worked to the amount of 8s. 6d., should go towards the house rent, the same as I paid previous to coming into this, and from December 10th, 1903, till March 23rd, 1905, I have given on the average 9s. 10½d. per week, and have had to use my own tools to do the repairs. A set of drills and tops were bought a few months back. In August, 1904, the refuse destructor and sewage works were placed under my supervision, as two drivers were discharged to cut down expenses (their wages were 27s. per week), and the two stoker-drivers received 2s. 6d. rise, which brought their wages to 30s. per week, to do the extra work.

This is not the first time I have tendered my resignation; it is the fourth time. Some weeks I have worked 70 to 80 hours; once I was on duty 35½ hours, and the last 5½ hours I kept the town's light going myself, attending to switch-board, engine, and boilers and stoking, and sent for the night men to come and relieve me, and yet I was told by one of the committee that I had got a good job, and I lived rent free. It has been so good that I have left it, and have had enough of central station experience to last me for some time, although I am looking for another situation to support my wife and three children. I have 17 years' good references, and a certificate for electric lighting and power distribution:

J. T. Butler,
Works' Foreman.

Dartford, Kent.
October 10th, 1905.

Boiler Explosion near Truro.

One person was killed and another injured by the above—a very modest result, taking into account the facts of the case. Even this result, however, was clearly shown to be due to the incompetence of a particular person who called himself an engineer—probably a "practical engineer," a term dear to the hearts of those whose training has been very one-sided and imperfect. This case is but one of many which ought to be far more widely known, as then there would be more chance of the Government, or properly qualified engineers themselves, taking action and making it illegal for any person to style himself an engineer and practise as such, unless his name were "on the rolls" in the same way that medical men's and solicitors' names are.

Architects and teachers of music have been making a move towards getting registration for their callings, though even without this precedent, engineers should be prepared to do the pioneer work that their profession frequently requires. Surely engineering is important enough? Is it not the framework and motive power of all modern civilisation? Imagine the world without any bridges, railways, steamships, docks, electric light and power, gas, telegraphs, engines or manufactories of any kind! Then why endanger life, and hinder progress and manufactures, by permitting incompetent people to practise? Such persons have no reputations to lose, and no heavy professional training expenses to cover; hence they offer—often in utter disregard for any etiquette—to do work at ridiculous fees, such as it is impossible to do the work well and safely for. In the case in point the "fee" was 1s. 6d. for inspecting and reporting on a portable engine and boiler! The public cannot judge, and, of course, are tempted to employ the cheapest man.

I shall be glad to hear from any engineers who sympathise with registration, and who are anxious to improve the status of the profession, with a view to taking some action.

A. S. E. Ackermann.

Westminster, S.W.,
October 9th, 1905.

Defective Intelligence.

I note with pleasure the item in the current number of the REVIEW with regard to Messrs. Foster's success in securing an order at Peckham Rye for their well-known arc lamps, but we note that these lamps are to burn 80 in series on 200 volts, and if space permits I should be glad to see some description of this system of arc lighting in an early issue.

Ern. E. Stewart.

London, S.E., *October 9th*, 1905.

[We did not say "80 in series"; we said the 80 lamps would be "burning in series," and so they will be. Not all in one series, however, but in 20 series. It is difficult, we admit, to avoid an occasional *double entente;* witness the heading of this letter, which may apply either to our item of news which is in question, or—well, nothing that concerns us.—EDS. E.R.]

Some Arithmetical Questions for Mr. Byng.

It is all very well for Mr. H. W. Wilson to speak of red herrings, and, at the same time, so to turn the title of this correspondence as to make it appear that the onus of proof lies with Mr. W. Pollard Digby. After all, the original cause of the correspondence was Mr. G. Byng's bombastic prophetic statement to the Press at the annual general meeting of his company; and it would be interesting to know why the mantle of this "Profit" Jeremiah has suddenly fallen on the shoulders of Mr. Wilson. Perhaps a further example of the "mutual confidence" we hear so much about. But this by the way.

Now, Sirs, if the true inwardness of Mr. G. Byng's manœuvres be examined, I am sure it would be found that he had his tongue in his cheek, and was saying, "What fools these Englishmen are; they don't see what a gigantic advertisement I am getting, and it all costs me nothing." At the risk of adding to Mr. G. Byng's free advertisement, I would suggest that in future he sends his "dicta" to the publishers, like Mr. Raworth does; and that "otherwise well-meaning" correspondents avoid the temptation of unconsciously acting as amateur G.E.C. advertisement managers. If Mr. G. Byng wants Protection for his goods, he must not expect Free Trade in advertisements.

Veritas.

I have no particular liking for arguments of the *tu quoque* order, but Mr. H. W. Wilson's last letter is really a little bit too cool. Talk of red herrings—why, Sirs, if fishy metaphors are to be bandied to and fro, Mr. Wilson's intervention is "very like a whale." Or, in view of his amendment of the title of the correspondence, his action has a parallel in that of the guinea fowl in an Uncle Remus story.

But, for the reasons stated in my last letter, I really cannot go into all the side issues of the fiscal question. I did not mean to answer Mr. Wilson's conundrum, but I did mean to suggest that his ideas on economic questions were somewhat crude. I do not feel inclined to withdraw my suggestion, particularly in view of the reiteration of the conundrum "How is it possible to give preference to imports of a life-supporting nature without placing an import duty on imports of a non-life-supporting nature?" I do not feel called upon to juggle with its sophistries at this juncture, but would observe in passing that Mr. Wilson must be either a very bold man to advance such theories from an agricultural centre like Stowmarket, or else be

lacking in a sense of logical justice. He would "protect" the manufacturer by putting an import duty on imports of a non-life supporting nature, but would ignore the agricultural interest which other protectionist countries particularly foster. In this Mr. Wilson seems to be curiously out or touch with his fellow protectionists, English, German, and polyglot. My main reason, however, for making a rejoinder to Mr. Wilson is the question of the need of statistics of internal trade. This is one of the crucial points of the question. In my letter of August 26th, I dealt with the fact that such statistics were necessary. But Mr. Wilson's memory is as faulty as his logic, or as deficient as is his knowledge of economic laws, and he therefore glibly suggests that I have "introduced the usual red herrings," by referring to the matter in my last letter.

Statistics of internal trade are necessary if we are to consider the facts of import and export trade in their proper relation to each other and to the needs of our population. They have, in fact, *everything* to do with the case. If Mr. Wilson believes that the world can, when considering commerce, exist on two dimensions, he should, to be logical, affirm that in the manufacture of armour plates for our battleships, only two dimensions, either length and breadth, or one of these, and thickness were all that was necessary, and lack of the third might be made up by a vending of Yarmouth bloaters, or recital of Tariff Commission reports. The third dimension is vital to a fair consideration of the case. I can only suggest that the repugnance to the subject exhibited by Protectionists is not unconnected with a fear of truth and a dread of a right sense of proportion, having the effect of demolishing their theories, which, being only the product of two dimensions, are the embodiment of flimsiness.

W. Pollard Digby.

London, *October* 10*th*, 1905.

Lead-Covered Wiring.

Some time since I read with much interest letters which appeared in your "Correspondence" column respecting the merits and demerits of the steel conduit and wood-casing systems in wiring for electric light and power installations, but, as far as I can recollect, the question of the lead-covered system was left entirely out of the discussion.

In Lancashire I find that lead-covered wiring is being strongly advocated by station engineers in preference to any other system. I agree that it may be hygroscopic when sunk under plaster, and that it is easily subject to mechanical injuries, but I shall be very glad to have the opinion of some of your readers on the matter.

I may say I am a strong supporter of the steel conduit system.

Cecil R. Whipple.

Liverpool, *October* 10*th*, 1905.

An Overcrowded Profession.

I have read the letter of the editor of the *Birmingham University Engineering Journal* which has appeared in your issue of the 6th inst., and I must say I am unable to understand what meaning is intended to be conveyed in the last three sentences of his letter, but believing that no discourtesy is meant, I will say no more. The fact is, I have taken much interest in reading about the Birmingham University from time to time, and I heartily hope that the founders and people of Birmingham may have the satisfaction of seeing it increase in prosperity and popularity as the years roll by. I think, however, that the British public would be glad to know from the editor of the *Birmingham University Engineering Journal* whether his university undertakes to give the practical, as well as the technical, training in any one branch of engineering, so that the student on leaving the university can be given a certificate to say that he has completed a full course of five or six years' technical study and practical work, and is thereby qualified to practice his profession, or to offer himself as a qualified man to any employer in need of a properly-trained man. This is what I mean by the words "complete training." And I mean also that if there were two or three large engineering colleges in England, with, say, one in Scotland and another in Ireland, where an up-to-date first-class technical and practical training could be given, we should not have cause to stand in fear of being overtaken and beaten by any other country in either engineering skill, quality, or output. There could not be "many" such colleges, as the editor of the *Birmingham Engineering Journal* suggests, for the reason that not more than a small number could be made self-supporting. It is all very well to talk about technical instruction and splendid laboratories, but until the practical training can be given as well as the technical, the electrical engineering profession, as well as the other engineering professions, will continue to be overcrowded, disgraced and dragged down by incompetent and insufficiently trained men—men who will work for any pay as long as there are employers to take them, the quality of the work, breakdowns and the public safety, being of secondary consideration. Is it not true that there are only a few of the big engineering firms who will take any trouble over students from technical colleges? And is it not known to all that a firm which advertises for premium pupils has, as a rule, but little business on hand?

R. Browne.

October 10*th*, 1905.

Your recently-published correspondence on the overcrowded state of the profession has almost without exception been devoted to the eternal discussion of the relative merits of the different ways of training as an engineer.

Fundamental as this question is, however, the differences of opinion that are manifested in regard to it incline one to the belief that its day of settlement is still as far out of sight as ever, and that the number of ways of qualifying as an engineer will always be tending towards the infinite.

In my opinion the function of a technical college is simply to render aid to the student in acquiring a sound theoretical knowledge, and not to assure himself that he is receiving a practical answer to the question, "How can I become a practical engineer." That such theoretical knowledge is necessary cannot be denied; but the manner of its acquisition, whether by private study wholly or by the help of correspondence or oral classes, is of small concern, provided that the fact is realised that a "complete training in a branch of engineering" is not being received.

As you yourselves pointed out last week, the most essential qualification for an engineer is experience. This brings me to a point which I maintain has an importance at least equal to that of the preliminary training.

Granted that a young fellow has received his so-called "training," his next step is to obtain a post where he may draw a living wage, and yet, what is of more importance to him, experience. The majority at the present time take up central station work, and for the sake of illustration we will imagine our embryo engineer as a shift engineer in a works of moderate capacity. He will have much to learn; but at the end of about two years, the limit will have been reached, the experience curve will be flattened, and his time will be spent in what has become routine work to him.

Then it is that he must seek for a change, not necessarily because he is dissatisfied with his present conditions of employment, but because he must consider that it is time to move to another class in the school of experience. This is the point that must be emphasised: *his employers should not ruin his future career by any selfish considerations.* They should reflect that for the sake of the profession, men with varied experience are necessary.

Unfortunately, several cases have recently come under my notice, of employers placing serious obstacles in the way when their assistants seek to better themselves.

One flagrant instance, not 50 miles from London, is that of the chief who refuses testimonials to his shift engineers, and instead of speaking in their favour when referred to, replies that they are only nominally shift engineers, and have no responsibility. This, when they sign the log-book as in charge of their respective shifts, and accept all responsibility for them!

It is a pity that such things are done, not only because of the victims, but for the sake of the reputations of the chiefs themselves.

It would be a good thing if, on taking up a new position,

one made the stipulation that a testimonial should be given at the end of every 12 months. This would obviate the often disagreeable necessity of asking, and would indirectly benefit the whole profession.

Perhaps others of your readers will give their views upon the matter.

Epsilon.

Design of Instruments and Meters.

After reading Mr. Edgcumbe's reply to my "homily," I really began to wonder whether it had any reference to my letter at all, as I found all sorts of information that was quite unasked for, and noticed the conspicuous absence of replies bearing on the questions raised.

Mr. Edgcumbe refers to your issue of September 30th. I was not aware that the ELECTRICAL REVIEW was published both on the 29th and 30th of last month. I was at first tempted to think that your issue of the 29th was meant, but it seemed presumptuous to impute so gross an error to so painstaking a critic.

Mr. Edgcumbe's first thoughts were correct as to my meaning with regard to meters with "ball bearings" or "magnetic suspension." I should have said watt-*hour* meters. Truly, it is a matter to congratulate oneself upon, that really intelligent minds so readily appreciate one's meaning, in spite of its being so very obscurely hinted at.

It is quite refreshing to note that Mr. Edgcumbe thinks my previous letter a huge joke; just let him read it again, and note, among other things, the latter half of the third paragraph, which reads:—"I wonder if the makers imagine that switchboard makers and users wish to complicate unnecessarily the wiring of their switchboards." Will Mr. Edgcumbe answer this query, or will he not?

Again, does he not think that a pen using *fluid* ink, if decently designed (and such things do exist) is preferable to an "inkless" pen with all its attendant complications?

Mr. Edgcumbe is not quite sure that he understands the fifth paragraph of my first letter; I deeply regret his inability to do so, but should he care to read it again, I hope complete understanding will result.

His lengthy but vague statements in explanation of the virtues of his recorder can hardly be considered in the light of an answer to the points I raised.

It is to be hoped that the modesty which forbids the repetition of the compliments showered upon them at Olympia will be at least as much in evidence in the future as it has been in the past.

I think that this reply to Mr. Edgcumbe's letter should not call forth a very long epistle from him; in fact, I believe he will be able to answer the above questions in a few lines, should such be his desire. We shall then know *all* about the "inkless recorder."

O. K.

Foreign Electrical Apparatus.

I have read with some indignation and surprise the article which appeared in the *Daily Mirror* of the 9th inst., headed "Made in Germany," "More Disclosures," &c., especially in regard to the following extract:—

"Electrical fittings which will stand for years in Berlin will not survive the London fogs for six months," said Mr. Hirst, the managing director of the General Electric Co., to the *Daily Mirror*. "The foreign makers do not reckon upon the disastrous effect which our damp climate has upon *electrical material*."

(The italics are mine.)

There will, I think, be many in the electrical trade and profession who may remember the time when Mr. Hirst and his fellow countrymen acted as agents on behalf of foreign electrical manufacturers. The success which attended their efforts has, no doubt, enabled them to manufacture a great many of the goods they sell in this country, and they would evidently like it to be inferred that this applies to everything they supply. It would be interesting to know what percentage of the following articles, amongst others, that they sell are made in England:—Wires and cables, glassware, bell-pushes, insulators, bronzes, fans, lift and other controllers.

Being myself interested in the importation of some foreign-made articles, I write this as a protest against the indiscriminate mud-slinging that has been going on, directly and indirectly, for so long. Any of the articles above enumerated can be made in this country; but if it is necessary, for reasons of economy, to buy them abroad, the purchasers are not justified in, to say the least, adopting towards others the attitude indicated in this article.

Anti-Humbug.

Behaviour of Tantalum Lamps on Alternating Circuits.

Many hundreds of thousands of the above lamps have now been sold, and a considerable amount of experience with regard to their behaviour has been obtained. As a result it has been shown that when used on alternating-current circuits, the results are not so good as on continuous-current circuits, the life of the lamp frequently being considerably shortened, and the globe showing a tendency to blacken. We should be obliged if you would kindly give this information prominence, as we recommend, for the present, that the use of tantalum lamps should be restricted, as far as possible, to continuous-current circuits.

Life.—We are frequently asked to state the life of the lamps. Of course, as regards individual lamps, it is as impossible to make any statement, as with any carbon filament lamp, but experience has shown that on continuous-current circuits the useful life may be assumed generally as being between 400 and 600 hours, and in many cases it is actually even longer, whilst the total life often greatly exceeds 1,000 hours.

2·2-watt Lamps.—We have previously informed you that the candle-powers of the lamps of various voltages are proportional to the standard candle-power of the 110-volt lamp (23 British C.P.). We have had many inquiries as to why we do not put the 110-volt lamp on the market with a candle-power somewhere about 16, the general opinion being that 23-C.P. was too high for most requirements, although the current consumed is actually less than for the carbon filament lamp of 16-C.P. According to present manufacturing arrangements, in order to reduce the candle-power, it is necessary to have a lower voltage lamp so as to secure the same high efficiency. We are now prepared to accept orders for 2·2-watt lamps for pressures of 50, 55, 60, 65, 73-75, 100 and 110 volts.

These lamps have a useful life of about double the duration of the lamps described above, and give 30-40 per cent. less light, with an efficiency at starting of 2·2-2·4 watts per candle-power. For instance, the 110-volt lamp of this type gives a light of about 14½ C.P., with an efficiency of 2·2 watts per candle-power. Its useful life is about 800 to 1,000 hours, and the total life often reaches 1,500 to 2,000 hours. With the efficiency mentioned, a lamp having such a long useful life is, as you will no doubt agree, a great improvement on anything that has been done in connection with carbon filament lamps.

For **Siemens Bros. & Co., Ltd.,**
V. ZINGLER.

London, S.W., *October 10th*, 1905.

LANCASHIRE ELECTRIC POWER SUPPLY.

THE opening of the Radcliffe Power Station by the Right Hon. the Earl of Derby took place on Monday last, in the presence of between 300 and 400 guests. They travelled by special train per the Lancashire and Yorkshire Railway to Dingley Road, whence the Electric Power Co.'s station was reached by a short walk along the siding connecting the company's works with the main line. The power house was crowded when Lord Derby started the first turbo-generator at one o'clock. Amongst the gentlemen present were the Chairman of the company, Mr. F. E. Gripper Col. Sir Lees Knowles, Bart., M.P., President of the Institute of Mining Engineers; Sir David Richmond, ex-Lord Provost of Glasgow; Sir John O. S. Thursby, Bart., High Sheriff of Lancashire; Mr. C. W. Macara, President of the Federation of the Master Spinners' Association; Mr. J. K. Bythell, Chairman of the Manchester Ship Canal Co.; Mr. J. F. Aspinall, General Manager of the Lancashire and Yorkshire Railway Co.; Mr. Hewlett, Manager of the Wigan Coal and Iron Co.; Mr. Alderman Southern (Manchester); Mr. Wigham, electrical engineer; Mr. W. B. Hopkins, Mr. R. Matthews (of Armstrong, Whitworth & Co.); Mr. J. S. Raworth, Mr. Sillar, Mr. E. M. Lacey, and others. After Lord Derby had set the first turbo-generator in motion, Sir Lees

Knowles performed a similar duty for the second. Shortly afterwards the company assembled for luncheon in a marquee which had been put up close to the works.

The chair at the luncheon was occupied by Mr. Gripper. After the health of the King had been given, Lord Derby proposed "The Lancashire Electric Power Co." He said that everyone who had visited America must have been struck with the extent to which the great rivers—and Niagara itself—had been utilised for transmitting power. England had no rivers capable of furnishing power for the service of the industries on their banks; therefore, like men of business, they must make the best use of what they had. If the coal of Lancashire could, without the expense of transport, be utilised for the production of power, almost at the pit's mouth, a great industrial problem would have been solved. The Lancashire Electric Power Co. in their admirably equipped works had shown what could be done. On the question of cost he could not speak with authority; but that the cost of manufacture, in some trades, would be greatly reduced by the use of electricity was incontrovertible. There were boundless possibilities for the development of the smaller industries of this district; but the public mind would have to be disabused of misunderstanding, and possible prejudice. Possibilities of danger must be guarded against. If they were bound to carry their high-tension cables all underground the cost, it seemed to him, in such a district as that, would be prohibitive. It remained to be seen how far public opinion would sanction the transmission of current otherwise. There was no reason why it should not, if proper safeguards were provided; and he was convinced, so far as that company was concerned, from all they had seen, that everything possible would be done to ensure safety. The use of electricity in place of steam might be discussed from the point of view of its effect on the atmosphere. Electricity as a motive power had a great future, in small as in large industries. Everyone who helped it forward would confer a benefit on industry, not only on the score of economy but also in promoting the health and general well-being of the community.

The Chairman, in responding, expressed the pleasure of the directors in meeting so large and representative a gathering of Lancashire men. It showed the great interest that was taken in that particular industry. The distribution of electric power (the chairman continued) was attracting the attention of the country in general, and in no part of the country was it attracting more attention than in Lancashire; because they looked upon Lancashire men, from the mechanical standpoint, as the leaders of the country. It was no use providing an electrical supply unless they could do it cheaply. The manufacturer or colliery-owner, in providing power, took a lot of persuading before he would adopt anything new. He wanted to be shown that he was going to gain in one of two ways—either he must save in expense or in the matter of convenience. In either case, if they showed him that he was going to make a considerable saving, he was amenable to advice, and prepared to adopt the new system. As far as plant was concerned, their engineers had provided machinery of the most modern type. It would be a revolution to many to see 2,000 H.P. crammed into the small space occupied by one of those turbines—so different from the practice of Lancashire engineering that they had been used to in the days gone by. They had installed, or were about to have installed, four turbines capable of developing 6,000 KW., and they had already, on opening the station, got applications that would absorb more than half the available power. Promoters of power schemes had always claimed as one of their greatest advantages that a cheap supply of electricity could be brought into districts which otherwise would present no special attraction for manufacturers to come and settle. In this particular case of Radcliffe they had an example. They had already arranged for the supply to a new works which was going to be brought within a quarter of a mile of their station which would absorb 1,500 or 2,000 H.P. That industry would never have come to Lancashire if the Electric Power Co. had not been there. There were other applications of a similar kind likely to come to business. In these ways they might fairly claim that they were doing good to this district.

Mr. T. O. Callender proposed "The Guests."

Col. Sir Lees Knowles, M.P., in responding, referred to himself as representing in a sense both the coal and cotton industries. At Pendlebury, he said, there was a mill built before he was born by his great uncle, Robert Knowles, and side by side with it there was now one of modern type—such as he had seen in America—containing 75,000 spindles, electrically equipped, and without a chimney. It had been started that day. The existence of those two mills side by side was to him most extraordinary and significant. The modern mill was a monument of progress. Instead of water, coal had been used, and he, for one, had a sympathy with the use of coal. They had heard from the chairman of a new industry which was about to be introduced into South-East Lancashire. It was the aluminium industry. He was not quite sure what could be done with old establishments—collieries, for example—which had been long worked under other systems. He was interested in collieries at Pendleton, one of them the deepest in the United Kingdom, and he doubted if it would be worth their while to remove the old plant and substitute for it something that was entirely new; but he certainly thought it would be worth while for anyone sinking a new pit, or building a new mill, to turn his attention to electricity. He wished the Electric Power Co. all prosperity.

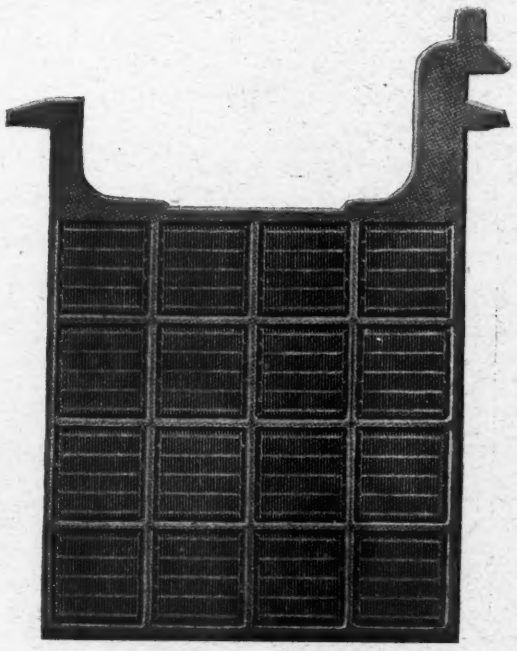
Sir David Richmond proposed "The County and Trade of Lancashire," and Sir John Thursby responded.

Mr. C. W. Macara also responded, as representing the Lancashire cotton trade. He was glad that among other industries an experiment was to be made with the electrical driving of a cotton mill, and he had no hesitation in saying that this would be watched with the keenest interest, especially at a time when a great extension was taking place in mill building.

The company, after drinking to the health of the consulting engineers, made an inspection of the works, and then returned by special train to Manchester.

BUSINESS NOTES.

The Bijur Storage Cell.—The accompanying illustration shows a new form of plate invented by Mr. Joseph Bijur, of New York, U.S.A. The essential features of this plate consist in its being made up of small separate sections, each of which is free to expand, while it is firmly welded to a strong supporting grid. Automatic machinery has been devised by the inventor for producing the sections at low cost, a new method of welding the thin



The Bijur Positive Plate.

parts of the sections to the heavy grids has been evolved, and a new process of formation has been adopted. It will be noticed that the sections consist of numerous small compartments, which are practically filled with peroxide by the process of formation. It is claimed that buckling cannot take place, and that the electrolyte has perfect freedom for diffusion through the plate, while greater capacity is secured, together with a greater reserve of lead. The battery is being placed on the market by the General Storage Battery Co., of New York, under the name of the Bijur "High-duty" type.

Battery Contracts.—The A.B.P. Accumulator Co., Ltd., of Stockton-on-Tees, have just completed the following contracts:—

60 17-plate S Type Renewal Sections for Blackpool Winter Gardens.
256 19-plate S Type Cells for Handsworth U.D.C.
60 9-plate M Type Sections for the Barry Railway Co.
60 Cells 21-plate S Type for Silksworth Hall.
60 Cells 17-plate S Type for Brompton.
54 Cells 11-plate S Type for Ivybridge.
36 Cells SSS 9-plate Type for the S. Y. *Calanthe*.

They have also booked the following:—

54 17-plate S Type Cells for Portishead.
55 7-plate S Type Cells for Chester, and
54 11-plate S Type Sections for Wilmslow, near Manchester.

Correction.—In the notice which appeared in our issue of the 29th ult., regarding small lighting sets, the title under the illustration read:—"Reavell-Verity" lighting set. As a matter of fact, the illustration was reproduced from a photograph of one of the L.C.C. River Steamer Lighting Sets, for which the dynamos were made by the Thames Ironworks, Electrical Department.

"Premier" Accumulators.—We have received particulars of a number of tests on the new storage cell invented by Mr. A. Schanschieff, which appears to give remarkable results. The Premier Accumulator Co., of Military Road, Northampton, is taking up the manufacture of these cells.

We are informed that a 7-plate cell, each plate measuring 8 × 8¾ in., can be fully charged, repeatedly short-circuited until zero voltage is shown, and then recharged; after this drastic treatment a capacity of 192 ampere-hours is given with a 12-hour discharge, and 85 ampere-hours if the cell is discharged in one hour. The plates are of the "Faure" type, and a cell such as that described above weighs 48·5 lb. The above-mentioned results were obtained, amongst others, from a cell which had been charged and discharged 200 times, and short-circuited for from one to four days.

We understand that a new Planté plate, for making which special machinery has been devised, is also under test.

Book Notices.—*The Romance of Modern Mechanism.* By A. Williams. London: Seeley & Co. 1906 (*sic*). Price 5s. net.—This is one of a series of popular works, of a kind which may be welcomed as well adapted to arouse the spirit of inquiry, and to awaken the interest of readers unversed in scientific and technical lore. Even those others who are expert in such matters will find many things worth reading in these books, for no one is expert in everything, and the expert in electricity, for example, not having leisure to scan text-books on petrol motors, the machinery of ships, the handling of grain, &c., may well find recreation in a popular treatise dealing with these subjects—provided always, and essentially, that the author knows what he is about, and does not disgust the reader by technical solecisms which the latter, although engaged in other walks of engineering, can readily detect. While electrical apparatus frequently crops up in the book before us, there is not a great amount of purely electrical matter, probably because this is to be dealt with in a separate volume by another author; however, on the lines that we have indicated above, this fact may, perhaps, be regarded as an advantage rather than a drawback. The book would make an excellent gift or prize for a boy. It might with advantage be furnished with a greater number of illustrations, to explain descriptions in the text.

Electricity in the Service of Man. By Dr. R. M. Walmsley. London: Cassell & Co. 1905. Part I.; price 6d. net.—This popular treatise, to which Dr. Walmsley has imparted new life and vigour, was reviewed in our columns some time ago, and is now being brought out by the publishers in fortnightly parts; we trust that it may thereby gain a wider circulation, such as it deserves.

"Boletin de la Cuarta Seccion de Jeografia i Minas." May, 1905. Santiago de Chili: Direccion Jeneral de Obras Publicas.

"The Elements of Electrical Engineering." By T. Sewell. Third edition. London: Crosby Lockwood & Son. 7s. 6d. net.

"Berechnung und Entwurf Elektrischer Maschinen, Apparate und Anlagen," by Dr. F. Niethammer. Vol. III.—"Elektrische Schaltanlagen und Apparate samt Grundlagen zur Projektierung Elektrischer Anlagen." Stuttgart: Ferdinand Enke. M. 16.

Theft at Olympia.—On Friday night last, we are informed, some miscreant, who must have suffered severely from *cacoethes scribendi*, appropriated about £70 worth of Waterman "Ideal" fountain pens from the stand of Messrs. Tollit and Harvey.

Trade Announcements.—The Crathorne and Green Manufacturing Co., manufacturers of the "Meridian" arc lamps, have removed their head office and works to larger and more convenient premises, situated at Wagner Street, Old Kent Road, S.E., to which address all communications should be sent.

Messrs. Falconar, Cross & Co., of 4, St. Nicholas Buildings, Newcastle-on-Tyne, have taken over the whole of the business lately carried on by Mr. S. H. Gowdy, electric light and power engineer, at 59, Grey Street, Newcastle-on-Tyne.

Messrs. James Willing, Jun., Ltd., newspaper advertisement contractors, have removed their West End branch from Piccadilly to 73, Knightsbridge, London, S.W.

Dissolutions and Liquidations.—Electrical Fittings Co., Ltd.—A meeting is to be held at 65, London Wall, E.C., on November 10th, to hear an account of the liquidation from the liquidator (Mr. J. D. Pattullo).

Messrs. Spearing & Stark, electrical engineers and contractors, 19, Broadway, Wimbledon, S.W., have dissolved partnership. The business will be continued by Mr. Spearing under the title of Spearing & Co., to whom all future communications should be sent.

German Electrical Trade during the first half of 1905.—An interim report on German trade and industry for the six months ending June 30th has just been issued by the Foreign Office. Despite the coal strike, the home demand in other industries was good, and the electrical industry was well employed. In regard to the electrification of the railways, Mr. Consul-General Schwabach, who has prepared the report, states that progress in this direction is confined to a few suburban lines, no decision having been arrived at with regard to long-distance railways. Plans are said to be under consideration for the introduction of electric services between Düsseldorf and Cologne (23 miles) and Berlin-Hamburg (185 miles). In the various items of export trade of which details are given, mention is made of electrical machinery, the exports during the period under review weighing 6,632 tons, and being valued at £530,600. Particulars are given of the new "Purchase Office for Electrical Works," which was established in January, 1905, by 28 members of the Vereinigung der Elektrizitätswerke. Its principal object is to buy for joint account materials required by electrical works, and it also collects manufacturers' offers, and settles buying and delivery conditions with them. Members are obliged to meet exclusively through the office their ordinary requirements for ordinary carbon filament incandescent lamps, and such other materials as may be decided upon at a general meeting.

Consular Notes.—Greece.—The German Consul in Athens in a recent report states that the cotton mills and lead-washing establishments at Lausium are substituting suction gas engines for steam-power, and are favouring German rather than British plants. The Compagnie Française, of Lausium, are proposing to install an electro-magnetic plant for the separation of the metal-holding residues from lead washing, and have entrusted its erection to a German firm. The Compagnie Hellenique d'Electricité System Thomson-Houston, to which was entrusted the work of applying electric power to the Athens-Piræus Railway, now proposes to convey electric power for lighting purposes to Patissia by cable and thence overland to Kephissia and Tatoi, the summer residence of the King. The works are in course of construc ion. The works for the conversion of the tramways from steam to electrical working are in course of construction, but have not yet been completed. The application of electricity to the Athens-Piræus Railway has been very satisfactory, but great complaints have been expressed regarding the rolling stock.

Spain.—The German Consul at Seville reports that the imports of German electric lamps have increased rather than diminished, owing to the fact that the factory which has been erected in that town has not yet been set to work.

Mexico.—The German Consul at Guadalajara (Mexico) reports that both the tramway companies in the town, which have a length of line of 40 kilometres and 11 kilometres respectively, are actively considering plans for the introduction of electrical power. The La Electra Co. is said to have arranged with an American electrical company for the carrying out of these works. The company named has also the concession for the lighting of the town. The Consul also states that the adoption of electricity for lighting streets and dwellings is also gaining ground in the neighbouring towns. The industry is in a very favourable position, owing to the large quantity of water-power available. All the larger factories and even the smaller ones have gradually given up the use of steam power. Several electrically driven maize mills have recently been erected for the production of "Nixta" meal, which is used for making "Tortilla" maize bread, one of the chief foods of the lower classes. This method does away with much hard female labour, as on the old principle the corn was ground by means of stones.

Italy.—In Salerno and district there is a not unimportant demand for electrical material of all kinds The electric works at Tusciano are already finished, and electrical power is being used generally. Many of the macaroni factories are run by electricity, and a large landowner has applied electricity to ploughing and other agricultural work. Electric lighting is to be undertaken in several towns. Up to the present electrical materials have been obtained chiefly from Germany and the United States.

Acheson Graphite.—The International Acheson Graphite Co., of Niagara Falls, New York, with the recent completion of a large extension equipped with the most modern electrical and mechanical appliances and machinery, has doubled the capacity of its plant for treating graphite in the electric furnace, and has closed a contract with the Niagara Falls Power Co. for another 1,000 H.P. of electrical energy in addition to the 1,000 H.P. previously used. The commercial importance of this artificial graphite may be estimated from the fact that the United States Geological Report for 1904, states that for that year the value of Acheson graphite produced was $217,790, while all the graphite mined in that country amounted merely to $341,372. New York State, which is considered rich in deposits, according to the official report of, 1904 produced natural graphite worth $119,509. Acheson graphite is largely used in the manufacture of metal protective paints, dry batteries, stove polish, packing, and as a lubricant. The electro-chemical processes also consume an extensive supply of Acheson graphite electrodes.

Transporter Bridge for Warrington.—Messrs. Thomas Piggott & Co., of Birmingham, makers of pipes, tanks and steel structures, have obtained an order for a transporter bridge at Warrington.

The Alleged Electrical Frauds Case.—The further hearing of the charges against Leslie, Cheesman, Webber and Rosenberg of conspiring to defraud electrical firms in the City, occupied Alderman Sir John Bell, at the Guildhall, on Friday last, when further evidence was given.

For Sale.—On October 24th, 25th and 27th at Bradford, Mr. Arthur Haley will offer for sale by auction the stock, installations, patent rights, &c., of Edmondson & Purdom, Ltd., electrical and mechanical engineers, now in voluntary liquidation. Some particulars appear among our advertisements to-day.

Messrs. P. Huddleston & Co. will, on October 19th, offer the stock of an electrical engineer for sale by auction at Manchester. Some particulars appear among our advertisements to-day.

Nernst Lamps.—A tiny booklet (No. 181) entitled "Some Light Talk," has been issued by the Electrical Co., Ltd., for distribution to small contractors and private consumers. It gives, in brief, information about the lamps, pointing out their advantages, and explaining how to overcome difficulties sometimes experienced. The great saving effected by Nernst lamps is clearly demonstrated, when an entire installation of existing lamps is replaced by Nernst lamps, and the company guarantees such installations in full for a week's trial, and undertakes to replace all lamps without any charge whatever, if the claims about saving in current or increase of light are not verified by the test.

Imports of Foreign Telegraph Cables.—The value of the foreign telegraph cables imported into this country during last month amounted to £4,319, bringing up the total for the first nine months of the year to £39,610, as contrasted with only £33,036 in the corresponding period of 1904.

Asbestos Cement.—We have received a sample of fireproof asbestos insulating cement, for which high qualities are claimed. It is supplied by Mr. C. A. Line, of 81, Albert Street, Birmingham. The sample, $\frac{1}{32}$ in. thick, is stated to have withstood a pressure of 2,500 volts.

Exports of British Electrical Machinery.—September proved to be rather a quiet month as regards the exportation of electrical machinery from this country, the returns just issued showing a total of only £39,605, as contrasted with £46,426 in August last, and £47,777 in September, 1904. For the year to date, however, the shipments are, however, well in advance of those of last year, being £473,064 for the nine months ending with September last, an increase of £118,558.

Milan International Exhibition, 1906.—The first Italian International and Universal Exhibition will be opened in Milan on April 15th next. It will be on a large scale, and the success of its International character has been already assured by the participation of France, Germany, Austria, the United States, and other leading countries. There will be nine International, and one National, Sections as follows:—

1. Land transportation—æronautics—meteorology.
2. Sea and river transportation (including ship's models).
3. Social economy.
4. Manufacturing and decorative arts.
5. Miscellaneous industries (machinery in motion).
6. Retrospective transportation exhibit.
7. Fisheries and pisciculture.
8. Agriculture.
9. Hygiene.
10. Fine arts (national).

A British Commission has been formed under the auspices of His Majesty's Government, which has made a grant of £10,000 for the creation of a British Section. In spite of the shortness of time at its disposal, the Commission has secured in the various buildings, space which, both in regard to area and position, will place this country on an equality with the various other foreign nations who will participate. Mr. Arthur Serena is hon. Executive Commissioner for the British Commission, and letters regarding space should be addressed to him at the London Chamber of Commerce, Oxford Court, Cannon Street, E.C.

Catalogues and Lists.—Max Kohl, Adorferstrasse 20, Chemnitz, i. S.—A very elaborate catalogue of 882 pages abounding in illustrations which show a great and interesting variety of apparatus for physical laboratories and preparatory rooms, experimental switchboards, accumulators, chemical balances, sciopticons, mercury air pumps, thermometers, induction coils, electric measuring instruments, X-ray outfits, vacuum tube apparatus, wireless telegraph and telephone apparatus. A recital of the mere titles of the different departments would occupy more space than we can spare; we must be content with remarking that the volume, which is very finely and strongly bound, is an excellent collection of the thousands of details coming under the category of physical scientific apparatus. The letterpress is chiefly in German, but partly in French, and some essential parts are rendered in English. An accompanying eight-page pamphlet gives particulars of prices.

Messrs. Alexander Ritchie & Co., 12 and 13, Upper Thames Street, E.C.—Catalogue of cast-iron pipes, air-tight inspection covers, skylights and sanitary appliances.

Portable Accumulators, Ltd., 210, Shaftesbury Avenue, W.C.—Price list No. 5, particularising and illustrating single cells and complete Tudor batteries in glass and ebonite, fitted with heavy discharge plates. Only cells of small capacity are included, but the same class of cell is manufactured up to 600 ampere-hours and above.

Messrs. Geo. R. Ousey & Co., 7, Bunhill Row, E.C.—List illustrating, describing, and giving prices of single and double flexible arm electric desk lamps.

Mr. A. P. Lundberg, Pioneer Electrical Works, Liverpool Road, N.—A number of recently issued pamphlets illustrating many Lundberg specialities, including armoured plugs, the "Pivot" intermediate switch, the "Duplex" and special tumbler switches, the pivot combination, and their various adaptations.

The Wandsworth Electrical Manufacturing Co., Ltd., 9, St. Paul's Square, Birmingham.—This is a 28-pp. illustrated catalogue of the "Wandsworth" tumbler switches, switch covers, wall plugs, counterweight sets, cut-outs, fuseboards, &c. We described some of the firm's switch manufactures in our "New Devices, Fittings and Plant" section last week.

Smoke Nuisance.—The British Westinghouse Co. were fined 10s. and costs, and £5 5s. extra costs, by the Manchester County Stipendiary, on 5th inst., for allowing black smoke to emit from their chimney in Trafford Park on August 3rd last.

There were 19 summonses against the British Westinghouse Co., and 19 against the Metropolitan Railway Co., heard at Willesden Police-court on 5th inst., for not complying with orders of the Court to abate a smoke nuisance. The informations, laid by the Willesden District Council, referred to one chimney shaft only, at the railway company's works at Neasden. It was urged for the defence that an expert had been specially brought over from America to stop the emission of black smoke from this shaft. So far he had not succeeded, and further steps were being taken. A fine of £1, and a guinea costs, was imposed on each of the 38 summonses.

Bankruptcy Proceedings.—G. & J. S. Robson.—A receiving order was made on October 3rd against G. & J. S. Robson (Robson, Robson & Co., electrical engineers, Newcastle-on-Tyne), on debtors' own petition. The first meeting is to be held on October 14th, and the public examination on October 19th, both at Newcastle.

Robert Pries.—On Monday, at the London Bankruptcy Court, Mr. Egerton S. Grey, Assistant Official Receiver, presided at the adjourned first meeting of the creditors of Robert Pries, electrical engineer and sundriesman, lately carrying on business at 75, City Road, E.C., under the style of Durtnall & Pries. The debtor left England for Germany before the proceedings were instituted, and he has now written from 28, Victoria Street, Altona, to the Official Receiver, giving the usual particulars required by the department. It appeared therefrom that he commenced business in October, 1901, with some cash capital and a small stock at Canterbury. From October, 1901, to April, 1902, he traded in partnership with Mr. A. H. Durtnall, and subsequently alone, but under the old style of the firm. On June 7th last he executed a deed of assignment in favour of Mr. J. R. Woodley, 30, Wood Street, covering the stock, fixtures, fittings, office furniture and book debts. His liabilities at that time amounted to about £1,500. The stock, purchased at a cost of about £750, was sold under an execution levied the day before the deed was signed, and fetched less than £200, whilst the fixtures, fittings, electrical installation, lift, &c., which had cost over £300, were claimed by the landlord. A petition was filed jointly by Hans Newman & Co. and John W. Sutcliffe & Co., Ltd., the act of bankruptcy alleged being the execution of the deed of assignment, and on September 6th a receiving order was made by the Court. When in England, the debtor resided at 46, Calabria Road, Highbury, and 82, Bunhill Row, E.C. He attributes his insolvency to shortness of capital, stagnation of business with consequent small turnover and large expenses, and to the loss of £150 during the last 18 months through bad debts. The chairman announced that, in the absence of any resolution by the creditors, the matter would remain in his hands to be wound up in the ordinary manner, the debtor's public examination being fixed for November 3rd. The following proofs of debt have been lodged:—

American Radiator Co.	£14 15 3
Finsbury Borough Council	8 16 10
Sutcliffe & Co., Ltd., J. W., and Peltisohn, John.. ..	169 16 9
Warner, J. and G. A.	32 12 6

A. J. Earp.—At Poole Bankruptcy Court on October 4th, before Mr. Registrar Salter Dickenson, the examination of Alfred John Earp, electrical engineer, of 12, Palmerston Road, Boscombe, took place. The accounts showed gross liabilities, £827 4s. 5d.; unsecured liabilities, £794 8s. 11d.; assets, £306 19s. 4d.; deficiency, £487 9s. 7d. Debtor gave as the cause of his failure "undue pressure by creditors." The Official Receiver asked him whether it was not rather due to the fact that, whilst the net profit from the business from August 15th, 1904, to the date of the receiving order was but £51 4s. 2d., the household expenses alone came to £208 13s. 9d. Debtor replied that the latter were not in any way very extensive. He asserted that he had had to pay builders, in whose places he had done electrical work, secret commissions of 10 per cent. and an additional 2½ per cent. to get the money. Such payments in a large measure accounted for his difficulties. The Official Receiver observed that it was money improperly paid out, and the Registrar said that the wretched system of secret commissions was nothing more nor less than daylight robbery. The examination was closed.

George Webber, Ironmonger, Putney.—On 9th inst. at Wandsworth County Court, an application was made by Mr. Tweedie Smith, on behalf of the trustee in this case, in which it was stated that the bankrupt had been prosecuted. The trustee, finding that there were many things requiring explanation, had obtained a private examination of the debtor before the Registrar. The debtor, however, had refused to answer questions unless they concerned matters which were far away from any point which might incriminate him, and the Registrar had consequently reported his contumacy to the judge. Although this was an application to attach the debtor for disobedience, he (Mr. Tweedie Smith) was willing that the matter should stand over, pending the result of the criminal proceedings. Mr. Cooper Willis, on behalf of the debtor, said he had come there prepared to argue that the questions put to the debtor when before the Registrar were improper questions, and were obviously put for the purpose of entrapping the debtor. He agreed that it was quite desirable that there should be an adjournment. The application was then adjourned, pending the completion of the criminal proceedings.

Electricity in Australian Government Printing Offices.—We read in *Australasian Hardware* that Messrs. Laurence and Hanson, of Sydney, recently secured the contract for the complete equipment of the Government printing and other offices with electric motors, ranging from ½ up to 10 h.p. In all 57 motors are to be installed, running at 480 volts, the current being supplied from the city Council's mains direct. This contract was placed in May last, and within three months from that date 54 motors had been delivered, and the bulk of them are now running. The motors were manufactured by the General Electric Co., Ltd., at Birmingham, and are of the enclosed type.

Rubber Concessions.—Tenders are being invited at the office of the Tender Board in Natal, till Monday, January 1st, 1906, for the lease of one or more sections in the Ingwavuma district of the province of Zululand, Natal, for the purpose of rubber extraction. A copy of the last report of the Conservator of Forests may be seen at the office of the Agent-General for Natal, 26, Victoria Street, London, S.W.

Hygienic Telephones.—We recently recorded the introduction of a combined telephone transmitter and receiver without a mouthpiece, the object being to obviate the lodgement of disease germs in the latter. We have little sympathy with the frequently recurrent agitation in this direction, for it has been proved more than once—notably by Dr. Collingridge—that there is no

G.E.C. Hygienic Telephone.

danger of infection from this source, though a much-used mouthpiece acquires an unpleasant odour. However, we are now informed that the General Electric Co., Ltd., is about to place on the market another instrument designed to overcome all such objections, there being no mouthpiece or sound director whatever; apertures in the metal case give free admission to the sound waves, and good speaking is obtained without removing the instrument from the ear. The accompanying illustration shows the appearance of the instrument.

Theft.—For stealing cable ends, the property of the Bristol Corporation, John Brown, 57, storekeeper, was sentenced to 14 days' hard labour for one offence, and a month on a second charge; a labourer named John Langton, 64, was sentenced to seven days' imprisonment.

Italy.—A company has been established in Milan, under the name of the "Societa Idroellettrica Briantea," for the production and distribution of electrical energy and its application to various industries and plants. The capital of the company is fixed at 1,000,000 lire in 10,000 shares of 100 lire, with the option of increasing the capital to 1,500,000 lire by deliberation of the board of directors.

LIGHTING AND POWER NOTES.

Australia.—Newcastle (N.S.W.).—The City Council decided some time ago to increase its electric lighting plant, and a tender has been accepted for the erection of two B. and W. boilers, at a cost of £1,343, as well as a further tender for additions to the buildings costing £646. The Council intends to borrow £5,000 to complete these extensions. A garbage destructor may be erected to work in conjunction with the electricity plant, and this will entail the expenditure of an additional £5,000.

Melbourne (Victoria).—An additional 750-kw. d.c. steam generator is being obtained by the City Council from Messrs. Crompton & Co., at a cost of £5,250, exclusive of duty. Tenders have also been invited for the supply of 140 new flame arc lamps to be substituted for some of those now lighting the city streets.

Fremantle (W.A.).—Contracts have been let in England for six electric gantry cranes and 10 electric capstans for the wharves, at a total cost of £9,850.—*Australasian Hardware and Machinery.*

Barry.—A Cardiff paper states that the U.D.C. has decided to postpone for the present the question of promoting a Bill, and to apply for an extension for five years of the present agreement with the South Wales E.P.D. Co., which expires in July next.

Blackburn.—From September 16th to 23rd inclusive, an Electrical Exhibition was held at the Exchange Hall, under the auspices of the Corporation Electricity Committee, and organised by Mr. P. P. Wheelwright, the borough electrical engineer. The electric light fittings and accessories, and the small motors for driving and domestic purposes that were on view, formed an excellent display, which was made up entirely of exhibits by local and East Lancashire firms. The exhibition was visited by 13,000 people during the one week it was open, and proved an interesting and popular attraction to the borough.

Buncrana, co. Donegal.—On the 5th inst. the formal inauguration of a public and private electric lighting supply for the town took place. Mr. Swan, a local mill-owner, and his sons are responsible for the project. There was a large number of visitors, and after the ceremony a luncheon was partaken of at the Lough Swilly Hotel. The water-power of the river has been utilised for running two turbines, each of a capacity of 60 b.h.p., under a head of 60 ft. at a speed of 780 r.p.m.; these are direct coupled to two Crompton dynamos, each with an output of 80 amperes at 500 volts. As a stand-by, when water is scarce in summer, an 80-h.p. suction gas plant has been supplied by Messrs. Wm. Grice & Son, of Birmingham. Coupled to this is a 45-kw. motor-generator, to be used either as a dynamo for lighting the town, or as a motor for running the mill. The G.E.C. supplied the switchboard. The three-wire overhead distribution system has been adopted, the public lighting circuit being independent of the private supply. Arc, Nernst, and incandescent lamps have been installed. The contractors for the power plant were Messrs. James Gordon & Co., London; Mr. J. F. Maryon, London, and Mr. L. J. Lawless were engineers to the scheme. A local company has been formed under the title of the Buncrana Electric Supply Co.

Coal Mining.—An electrical installation has been put down at the Hulton Colliery Co.'s new Pretoria pits adjoining Hulton Park, near Bolton.

Continental Notes.—Spain.—A concession for the installation of a hydro-electric power plant on the banks of the River Espinalvet (Barcelona) has been granted.

Germany.—An electrically operated rolling mill for the production of ship plates has just been installed at the Baroper Walzwerke, Barop.

Italy.—Powers have been obtained for the erection of a water-power plant on the River Topino Chiago (Perugia) for generating electrical energy for lighting and power purposes in the Tevere district.

Crook.—The Lighting Committee has reported that a representative of the Cleveland and South Durham County Electric Power Co. has explained his company's proposals for the supply of electricity within the urban district. The Committee recommends that the Council apply for a prov. order at the expense of the power company, and that an agreement be drawn up to indemnify the Council against all or any expense incurred thereby. The U.D.C. has decided to hold a special meeting; in the meantime the agreement is to be drawn up and presented at the meeting for approval.

Dewsbury.—The Corporation Sanitary Committee is considering whether it should extend the present refuse destructor, or put down an entirely new plant, to work in conjunction with the electrical plant. The destructor now used is at one end of the town, and the electricity works at the other.

Dudley.—At a L.G.B. inquiry held last week into an application of the T.C. for sanction to borrow £21,000 for purposes of the E.L. undertaking, Mr. H. Ross Hooper, the inspector, severely criticised the method of keeping the accounts, and dealing with the loans sanctioned. Of the loan now asked, £6,000 was to cover the excess expenditure on previous loans dating as far back as 1899. He said a debt was incurred in 1899 which on March 31st last had not been paid off. The debt had gone on year after year; there had been an overdraft at the bank, and yet the accounts had been certified as correct. Mr. Hooper stated that it appeared to him that it was only about 12 months ago that the necessity for allocating each item of expenditure to its specific loan was realised; he felt very sceptical about the accounts, and would have to investigate them *seriatim*. Unless, he added, he was satisfied in every detail, he would not be prepared to recommend that sanction be given for the negotiation of the present loan. The inquiry lasted six hours.

Dundee.—On the night of October 5th, owing to a failure of one of the lead-covered cables in one of the outlying districts, which were laid a few years ago, a bad fire was started in one of the manhole boxes in Scouringburn, and threatened to ignite the adjacent buildings. It being impossible to disconnect this length of cable during such a heavy short circuit in the old type of disconnecting boxes, owing to their small size and their being in deep manholes, it was necessary to shut down a large part of the town at the station for a few minutes, to allow of the disconnection of the faulty length. The fault was not due to bad cables, but to the way in which they were laid.

Farnworth.—The U.D.C. has resolved that the following charges for electricity for power purposes shall come into force:—For the first 500 units per quarter, 2½d. per unit; for the next 1,500 units per quarter, 1½d. per unit; all over 2,000 units per quarter, 1d. per unit, subject to a discount of ½d. per unit if the accounts are paid within 21 days.

Greenock.—The T.C. has appointed a small committee to inspect electric lighting installations combined with refuse destructors which have been erected by municipalities in Scotland.

Handsworth.—The opening ceremony in connection with the U.D.C. electricity works took place on Monday last. Sir Alex. Kennedy is the consulting engineer to the scheme, which has been completed at a cost of about £45,000. Mrs. Holdsworth, wife of the chairman of the Council, unveiled a tablet near the main entrance, and Mrs. Tibbetts, wife of the chairman of the Committee, switched on the supply.

India.—Madras.—The Government has passed the grant of the licence under which Messrs. Crompton & Co. may generate and supply electricity to Madras. The premises vested in the Madras Port Trust are excluded from the provisions of the licence, that body not having agreed to all the terms provided in regard to other areas. Messrs. Crompton & Co. may enter into a separate agreement with the Trust in regard to the supply of energy to the premises of that body.

Irvine.—At a meeting of the T.C., the proposal by the sub-committee appointed to consider the matter, to carry out an electric lighting installation for part of the town at a cost of £6,600, was dropped.

King's Norton.—The E.L. Committee has recommended the T.C. to continue the negotiations with Callender's Cable and Construction Co., Ltd., Belliss & Morcom, Ltd., and the Electric Construction Co., Ltd., as to the proposed establishment of an undertaking under the E.L. Order, 1898, and to settle with them the terms of the agreements to be entered into by the Council with the proposed new company.

Langley.—The P.C. has received applications from the Slough and Datchet Electric Supply Co., and the Uxbridge and District Electric Supply Co., for its consent to their applying for an E.L. prov. order. The Council has unanimously consented to the former company's application.

London. — Marylebone. — In a report issued on Tuesday, the Electric Supply Committee stated that the number of consumers now being supplied from the Council's generating station is approximately 4,000. The whole of district C (comprising 3,400 consumers), which was formerly supplied from the North Street station, was transferred from the Electric Supply Co.'s system two months ago. The operations had been carried out so that probably not one of the consumers was aware of the change. The Edgware Road district was transferred a fortnight afterwards. This transfer was rendered more difficult owing to the fact that Edgware Road had been previously supplied with alternating current by the company, and was connected with the system of supply in Paddington; it was therefore necessary to change the whole of the arc lamps and other apparatus for those suitable for a continuous current supply. In addition to the foregoing, certain other large consumers in Oxford Street had been taken over. The consent of the B. of T. in reference to the application of the Council for consent to an increase in the pressure of supply was obtained on August 18th, since when the whole of the Edgware Road district, together with that of Oxford Street as far as Portman Street, has been changed over to 240 and 480 volts D.C. pressure. The total number of consumers changed over up to the 3rd inst. was 354, and it is anticipated, that a further 600 consumers will be changed over by the end of the present month. Owing to the fact that the supply of large areas has now been taken over from the company, and that to some consumers the supply is necessarily still at the old voltage, a considerable proportion of energy is wasted. The load required to be provided for, at the Council's generating station, is heavier than had been estimated (the engineer having reckoned on larger areas having been changed over to the higher voltage). The committee has, therefore, considered it advisable to approach the company with a view to obtaining the benefit of the option of supply in bulk, during the next few months. Until the question of tariff has been settled the committee has provisionally arranged the following charges:—Lighting purposes, 8d. per unit for 500 hours' supply on the maximum demand, and 1d. per unit afterwards; basement lighting, 2d. per unit; power purposes, 2d. per unit for 500 hours' supply on the maximum demand, and 1d. per unit afterwards.

The estimates for the year ending March 31st next were submitted. The expenditure is put down at £95,891, and the income at £97,693. This would leave a credit balance on the year's working of £1,802, which would reduce the debit balance carried forward from the previous 12 months to £3,374. It is stated that provision has been made for a material increase in the rate of interest for the coming half-year, and that, through the suspension of sinking fund payments for the first 2½ years, the account for the year ending March 31st, 1906, had been relieved of a liability amounting approximately to £14,300. The Committee considered that no provision should be made in the year's rates to meet electric lighting charges.

Hammersmith.—It has been reported to the B.C. that the total costs of the 16 Councils which joined in the opposition to the Administrative County of London and District Electric Power Co.'s Bill amounted to £4,885. The proportion payable by Hammersmith, upon the agreed basis of rateable value, was £230, plus also a sum of £129 for copies of evidence supplied. The charges have been placed to revenue account.

As a result of the objections lodged by the B.C. against the new assessment of the works, the rateable value has been reduced from £9,500, as proposed, to £6,500. The reduced assessment, however, is an increase of £3,191 over that at present in force.

Poplar.—The London and India Dock Co. has informed the B.C. that it would be prepared to consider the question of taking the whole of its supply of energy from the Council, if a low price were offered. The Committee has decided to offer a supply at ·885d. per unit, subject to a three years' agreement and a guarantee to take a minimum consumption of 350,000 units per annum, with a maximum load not exceeding a 100 kw. at any one time. The B.C. has been supplying the London Central Markets Cold Storage Co. under agreement for 3½ million units, with a minimum of 250,000 units at 1½d. per unit. The charge has now been modified as follows:—£3 per kw. and ·8d. per unit, less 5 per cent. for cash within 14 days, plus £125 per annum to defray interest on cost of cable; the minimum quantity is to be 750,000 units every three years, instead of 250,000 per annum, the actual consumption being charged and the balance settled at the end of every third year.

St. Pancras.—Further complaints have been received by the B.C. in regard to alleged nuisances arising from the working of its generating station and destructor in King's Road, and the matter is now being carefully considered by the Committee. The Committee has sanctioned the extension of the arc lighting system to 26 streets and roads at an estimated cost of £8,250.

Louth.—The T.C. has received from the L.G.B. an intimation that the Council's application for a loan of £17,000 for the establishment of electricity works has been refused, on the ground that the evidence adduced at the inquiry failed to show how the scheme could be worked with financial success.

Lytham.—The U.D.C. has sealed an agreement with Messrs. Foote & Milne, relative to the electric light.

Market Harborough.—The U.D.C. has decided at once to take the necessary steps to obtain powers for the establishment of an electrical supply, during the next session of Parliament.

Mynyddislwyn.—Messrs. Spickett, solicitors, Pontypridd, on behalf of a syndicate formed for the purpose of supplying electric light in the Rhymney Valley, have received permission for a deputation to wait upon the Council, to lay the scheme before it.

New Zealand.—Christchurch.—The Works Committee has been instructed to report on the question of installing an additional generating set at the refuse destructor, to meet the anticipated increase in next winter's load.

Ossett.—The B. of T. has informed the T.C. that it intends to revoke the Ossett E.L. prov. order. This order has been extended on two or three occasions, and now another appeal is to be made for "sufficient" time to carry out the scheme.

Oulton Broad.—The U.D.C. has accepted the offer of the local supply company, to light the streets with 20-c.p. lamps, at £2 2s. 6d. each per annum.

Pwllheli.—The T.C. has agreed with a Yorkshire syndicate not to proceed with its prov. order obtained a few years ago. The syndicate has offered terms to the Council, and it is stated, will provide the town with an electricity supply.

Queenborough.—The T.C. having expressed a desire to have a supply of energy for lighting, the Sheerness Electric Power and Lighting Co. has intimated that it is endeavouring to obtain powers for supplying energy to the borough.

Salford.—Commencing with the New Year, power consumers will be allowed to use 15 per cent. of their consumption of energy for lighting at the power rate.

South Africa.—King William's Town.—The Lighting Committee has reduced the minimum monthly charge for energy from 10s. to 7s. 6d.

Ladybrand.—The T.C. recently discussed the proposal to light the town by electricity, and the town clerk, after having made inquiries, reported having received an offer to supply energy at 1s. 3d. per unit if a concession for five years were granted. No decision has yet been arrived at.

Stalybridge.—The Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board has decided to apply for a loan of £14,900 for electricity purposes.

Stockport.—The T.C. has offered to supply energy to the B. of G. for the new hospital at 4d. per unit for the first £100 worth per annum and 3d. afterwards, and for power at 1½d. per unit.

Sutton Coldfield.—The T.C. has decided to apply to the L.G.B. for a loan of £3,000 for the extension of E.L. mains, services and meters.

Wantage.—With regard to the application by the Wantage Engineering Co. for a prov. order for E.L., the U.D.C. has decided not to object to the application.

Washington (U.S.A.).—From the New York *Times* we learn that the Census Bureau has issued a report on electric light and power stations for the year ended on June 30th, 1902, showing that there were in the United States 3,620 such stations, which cost in construction and equipment $504,740,352. The gross income was $85,700,605; and total expenses, $68,081,375. The total output for the year in KW.-hours was 2,507,051,115. The number of arc lamps was 385,698, and the incandescent lamps numbered 18,194,044.

TRAMWAY AND RAILWAY NOTES.

Audenshaw.—The U.D.C. has applied to the B. of T. for a year's extension of time for carrying out the Tramways Order, 1899, from December 9th next.

Ballarat (Australia).—The electric tramway service was inaugurated on August 13th. Altogether 9 miles of track have been opened, and it is hoped that six months hence an additional 5 miles will be completed. The power house, near Lake Wendouree, contains four dynamos, three of which are in working order. Stirling boilers are used to generate the steam. The service is being provided on a 30 years' lease by the Electric Supply Co. of Victoria, Ltd., who also have agreed to furnish the city of Ballarat and town of Ballarat East with electric light for public and private purposes.—*Australasian Hardware.*

Bournemouth.—It is announced that the new electric tramway between Bournemouth and Christchurch will be opened for traffic on Tuesday next week.

Buenos Ayres.—Government has forwarded to Congress a Bill authorising the Buenos Ayres Municipality to construct underground electric railways. The concessionaire is to work the lines for 40 years, after which all will pass over to the Corporation.

Messrs. Urdaniz & Co. have applied to the Municipality for a concession for a network of 70 kilometres of electric tramways. The routes asked for are very similar to those now being called for by tender by the Municipality.—*Review of the River Plate.*

Chili.—According to the *Diario Oficial*, of Chili, a concession has been granted to Don Ambrosio Olivos for the construction and exploitation of an electrical railway from Valparaiso, through the valleys of Casablanca and Curacavi to Santiago, and of a branch from the valley of Curacavi to Melipilla. The concession is for a period of 100 years from the date on which the railway is opened to public traffic. Gratuitous use of the lands necessary for line, stations, &c., is granted to the concessionaire. When the railway is finished the concessionaire is to be repaid any sums which he may have expended for customs duties on supplies destined for the railway, provided these sums do not exceed 600,000 pesos (peso = 1s. 6d.). Plans of the railway are to be presented for approval within 30 months, works are to begun within two years, and to be finished within five years from the date of the passing of the plans, otherwise the concession is to be forfeited. Tariffs for goods and passengers are to be submitted for approval. After 40 years the Government has the right to purchase the railway, and unless previously purchased the railway will revert to the Government after 100 years. The concession is not to be transferred to any foreign company without the express stipulation that the said company must renounce all diplomatic protection and must abide by the laws of the country.

Continental Notes.—Germany.—The German Minister of Railways is considering the question of supplying the whole of Prussia with high-speed electric railways, the minimum speed to be 220 kilometres per hour. The value of this system has been proved on the Berlin-Zossen line, and the Ministry is now negotiating with Belgium with a view to the construction of a direct line between Berlin, Cologne, and Brussels, the whole distance to be covered in five hours. The Belgian Government has already consented to a grant of 56,250,000 francs.

Durham.—At the meeting of the City Council on the 3rd inst. a letter was read from the B. of T. stating that it had agreed to a further extension for six months of the powers granted to the Electric Tramways Co., who proposed to lay light railways between the city and the adjacent centres of population. No further extension would be granted.

Halesowen.—The B. of T. has refused to sanction the transfer of the R.D.C.'s light railway order to the Empire Electrical Co., on the ground that the provisions of the order are not applicable to a company, and has intimated that the proper method for a company to adopt is to apply for a fresh order incorporating the terms of the agreement with the Council.

Halifax.—Two tramcars collided violently during a fog on Tuesday last, one car having just emerged from a loop on to the single line where the other was travelling. The fronts of both cars were badly smashed, and the drivers were injured.

Liverpool-Southport Railway.—The new accumulator station at Hall Road, on the Liverpool-Southport line of the L. & Y. Railway, is now equipped. The station contains 270 cells, which can yield a discharge of 1,600 amperes at a pressure of 600 volts, with the aid of a reversible booster. There are now four battery stations on this line of railway: one at Hall Road, and one at St. Luke's, which are at work; one at Grea Howard Street, and another at Freshfield, which are approaching completion. The batteries, which are of the Tudor type, would suffice to run a full service of electric trains, on week days, for one hour; and on Sundays for three hours.

London.—Stepney.—The Works Committee reported on Monday having considered communications from the L.C.C. and Poplar Borough Council, urging that, owing to the difficulties of the adoption of the conduit system along the route of the northern tramways, they agree to overhead traction. The Committee regretted being unable to depart from their former decision, viz., not to consent to the adoption of an overhead system of traction upon the tramways in Mile End Road, Grove Road, and Burdett Road.

Over-Bridge Trams.—At a meeting of the Court of Common Council last week, in view of the Court having approved that there should be some tramway communication between the north and the south of the River Thames, and as Parliament would not sanction the introduction of tramways on the Embankment to make a junction with the tramways from Kingsway, Mr. J. Harris suggested that, at the conference to be held with the L.C.C., the Bridge House Estates Committee should ask the L.C.C. to consider the formation of a new street on the south side of the Thames between Westminster and Blackfriars Roads, and that by a tunnel, or otherwise, communication be made between the trams of Kingsway and the trams on the south side of London. He pointed out that the L.C.C. was proposing to build a County Hall near where the suggested street would run.—Mr. Algar, for the Bridge House Estates Committee, said they would give careful consideration to any suggestion the L.C.C. might make.

Metropolitan District Railway.—On Monday last the District Railway opened a new station, to be known as "Barons Court," situated about mid-way between Hammersmith and West Kensington stations.

Manchester.—The Tramways Committee has decided to extend the system of parcels carriage by tramcars. Henceforth the guards of all cars will be permitted to receive parcels for transmission at any stopping place, provided that the parcels are properly stamped, and do not exceed 7 lb. in weight.

The Committee has resolved upon increasing the number of covered cars, which are very popular.

Newport (Mon.).—The Electricity and Tramways Committee has considered a valuation for rating purposes of the tramways and electricity undertakings, viz., £9,000 gross, and £6,000 rateable, and has resolved to appeal against the assessment as excessive.

Oxford.—The T.C. on October 4th decided in connection with the purchase of the tramway undertaking to take steps to promote a Bill in the next session of Parliament, containing the widest possible powers, without pledging the Council at this stage either to work or not to work the undertaking.

Rochdale.—The T.C. has decided, if the Whitworth U.D.C. obtains the necessary powers to construct tramways, to lease and work them on terms to be arranged. The Corporation cannot secure powers by a prov. order to construct the proposed lines in the urban districts, hence this decision.

South Shields.—At the meeting of the T.C. on the 4th inst., the question of the appointment of a general manager for the new electric tramways now being constructed was further considered. The Tramways Committee again reported in favour of the holding of the position by Mr. Cawthra, the electrical engineer, but, after a protracted debate, the report was rejected, and a motion that a general manager be advertised for at a salary between £200 and £250 per annum was adopted.

Swindon.—The T.C. has decided to apply to the B. of T. for a loan of £2,550 for the purchase of two tramcars, and to meet excess expenditure.

Torquay.—The announcement is made, in regard to the Torquay tramways, that the Dolter Co. are prepared to push on with the work as rapidly as possible. All offers by the company of every sort are now withdrawn, and the Act of Parliament will have to be strictly complied with. This means that the Corporation will, within a few months, be called upon to carry out the agreement to supply the electric power to work the tramways, the first section of which will, it is anticipated, be ready for working by about Christmas, or early in the new year. The only means by which this power can be supplied is by the proposed extension of the existing station, for which the Local Government Board inquiry has not yet been held for the required loan of £9,500.

United States.—Chicago.—The Chicago City Railway Co., in asking for a 20-year operating licence, offer to accept the licence in lieu of all other rights, with the option of purchase by the city. They also offer interchangeable transfer tickets over the lines of the Union Traction Co.; to change all cable lines to overhead or underground trolley system; lay new metals and introduce new cars, to be run as required by the city; to repair, sweep and sprinkle streets; to pay rentals on a percentage basis; to concede a 5 cent fare; and to publish accounts.

New York City.—A new tunnel is being talked about, to enter New York City at a point where it will most effectively connect with the present surface car system near Brooklyn Bridge. A careful review of the local traffic situation and of the large number of pending extensions and subway schemes shows that no relief to the present overcrowded conditions can be expected until 1910. Electric trains, consisting of 10 heavy passenger cars, travelling at

50 miles an hour, are now running on the Long Island Railroad between Brooklyn and Belmont Park, where a new racecourse has been recently opened. The New York City Railway Co., one of a group of allied surface traction companies, is putting in electrically-operated automatic points which can be thrown by the motorman by a sudden turn of the controller handle. Some large gasolene electric motor-omnibuses are to be put on Fifth Avenue to replace the present antiquated horse vehicles. These new omnibuses are being equipped by the General Electric Co. with 40-H.P. gasolene engines and two 45-ampere motors, in addition to a small storage battery for lighting and for starting the engine. The Lackawanna Railroad, coincidently with the opening of a new ferry service, has initiated an electric automobile service for the use of its passengers arriving in New York City.

TELEGRAPH AND TELEPHONE NOTES.

Atlantic Cable.—The Commercial Cable Co.'s fifth cable across the Atlantic from Canso, Nova Scotia, to Waterville, in Ireland, was completed on Friday last. Bad weather delayed the final splice in the cable, which was made at a point 187 miles off the Irish coast.

Guernsey.—On the 3rd inst. the new multiple switch-board at the States Telephone Exchange was inaugurated by Sir H. Giffard, Bailiff of Guernsey. The new board is fitted for 900 lines, and can be extended up to 3,000. It was made by the International Electric Co., to the specification of Mr. A. R. Bennett, consulting engineer, and Mr. R. McLean, resident engineer and manager. At December 31st last the total number of subscribers' lines was 1,162.

London. — Marylebone. — The Works Committee reported on Tuesday the result of the award of the arbitrator, in the matter of the refusal of the Borough Council to give its consent to the placing of certain telegraph posts and wires in and across streets and roads in the borough. The arbitrator (Mr. G. Paul Taylor) decided in favour of the Postmaster-General, and ordered the Council to pay costs.

New York City.—There are now 174,200 telephones in use in Manhattan and the Bronx boroughs, serving a population of approximately 2½ millions. More than 22,000 new connections have been made between January 1st and September 30th. As a result of a recent official inquiry, a reduced telephone tariff is promised in the spring of 1906, especially in view of the organisation of several new companies which threaten to compete for business in all parts of Greater New York. These new companies ask for a 25-year licence, and promise to supply a large number of free telephones for official use.

Pacific Cables.—Mr. Takahira, the Japanese Minister to the United States, has affixed his signature to Japan's agreement with the Commercial Pacific Cable Co. for landing rights at Yokohama. An agreement for landing rights at Shanghai was signed by China several weeks ago. According to the *New York Times*, the cable connections with both Japan and China will be made by extending the present lines of the company, which run from San Francisco through the stations of Honolulu, Midway and Guam to Manila. Japan will be reached by laying a cable from Guam in the Pacific Ocean direct to Yokohama. The cable to China will be laid from Manila to Shanghai. With the cable which has just been completed to Newfoundland, plus a fifth cable to Europe which has now been laid, the cable from Guam to Japan, and one from Manila to Shanghai, the company will have a system extending over two-thirds of the way around the globe.

Mr. C. H. Mackay, president of the Commercial Cable Co., stated in New York on September 29th, that the new American cable to China and Japan will be in operation on or before April 1st, 1906. Mr. G. G. Ward, who has been to England to order this cable, sailed from Liverpool on September 29th.

Peru Telegraphs.—In his address to Congress, recently published in the *Diario Oficial*, the Peruvian President observes that in the year 1904 there have been constructed in Peru 743 kilometres of new telegraph lines between Lima and Casma, from Putina in the direction of Sandia, and from Piura in the direction of Ferrenafe. The latter line, in which the Government have taken great interest, was to be finished on July 28th, and will provide communication between north and south of the Republic, and international communication by means of the Bogota-Quito line with Lima, La Paz, Santiago and Buenos Ayres. After the work is done of changing the posts on the southern line and of adding a second wire, the Republic will be in a position to contract telegraphic conventions with the countries interested, which should have a beneficial effect on Peruvian commercial relations.

Roumania.—The works on the direct telephone line between Bucharest and Buda-Pesth were nearly completed on August 31st, and at the end of that month the new line was to be put into regular service. The Roumanian service is fixing the line between Sinaia and Predeal, whilst the Hungarian service is fixing the line between Predeal and Brashov, where the direct line with Buda-Pesth is joined. When this line is finished, Bucharest will be in telephonic communication with two centres of international communication, viz., with Buda-Pesth *vid* Predeal and Brashov, and with Sofia by the direct line between Bucharest and Giurgevo, the Danube cable between Giurgevo and Roustchouk, and the direct Bulgarian telephonic line between Roustchouk and Sofia.

Spanish Telegraphs and Telephones.—According to the *Journal Télégraphique* 3,549,378 telegrams were dealt with during the year 1903, viz., 2,997,169 private, 386,462 official, and 165,747 service. Of the international traffic, 538,245 telegrams were sent and 633,275 received. There were also 122,391 telegrams in transit; 32 new stations were opened during the year. It is interesting to note that the various officials hold telegraph conferences among themselves, and that messages in connection therewith are treated as service telegrams, which in 1903 totalled 271,918. Altogether the increase of internal traffic over the year 1902 was 2 per cent. and international traffic 1 per cent. France leads in the exchange of telegrams, having received and sent 471,486, Great Britain following with 256,772, and Germany with 89,524. The total receipts amounted to 5,629,563 pesetas in 1903, as against 5,493,049 in 1902. Expenses were about 8,437,455 pesetas. Telephone receipts were 3,116,438 pesetas, of which 751,066 were payable to the Government.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Trinidad-Demerara (No. 1)	Aug. 26, 1901	
Dominica-Martinique	May 7, 1902	
St. Lucia-Martinique	May 7, 1902	
Cayenne-Pinheiro	Aug. 13, 1902	
Reissa-Issa (Yemen) Camaran	Oct. 22, 1902	
Tarifa-Tangier	Jan. 18, 1904	
Closed { Vladivostock-Nagasaki	Feb. 9, 1904	
Closed { Port Arthur-Chifu	Mar. 9, 1904	
Jamaica-Colon	Jan. 5, 1905	
Cadiz-Tenerif	July 20, 1905	
Cotonon-Grand Bassam	Oct. 4, 1905	
Landlines.		
Puerto-Barrios	July 28, 1902	
Kertch-Soutchoum	Sept. 27, 1904	
Alaska landlines	Oct. 5, 1905	Oct. 9, 1905
Communication with Brazil *via* Galveston	July 18, 1905	

Turkey.—The Administration des Postes et Telegraphes Ottomans has published statistics for the year 1319 (*i.e.*, year ended March 31st, 1904). The following are the chief details:—Length of line 41,991 kilometres, being an increase of 1,171 kilometres, as compared with the previous year. Length of telegraph cables, 637,660 kilometres. Number of messages circulated, 1,537,054, giving total receipts of 85,893,018 piastres (100 piastres = 18s.)

Wireless Telegraphy.—The President of the Peruvian Republic states that a contract has recently been arranged with the "Gesellschaft für Drahtlose Telegraphie" for the installation of a wireless telegraph system between Puerto Bermudez and Masisea. The materials for this work have already been obtained and appear to be satisfactory. It is intended to set up a new station in Iquitos, thus solving the problem of telegraphic communication with the East. The contract contains a clause safeguarding the interests of the Government if the installation does not fulfil expectations.

Three engineers of the Ges. für Drahtlose Telegraphie, who have been on the way with the two stations to be installed in the interior of Peru since February 6th, have only just arrived in Masisea and Puerto Bermudez, after having met with great difficulties in the transport of the machines and iron towers. This transport, on account of the low level of the water and the many cataracts, had to be effected principally in open boats. The erection of the stations will be taken in hand in the course of the present month.

From *Indian Engineering* we learn that wireless telegraphy with the Andaman Islands is very successful, and that signals were recently exchanged between Port Blair and a vessel over 100 miles out at sea.

On September 24th the U.S. Government made some simultaneous experiments with wireless signals, receiving messages at Washington, D.C., from New York, Boston, Philadelphia, and other places, with a view to gathering information as to the most efficient wave lengths suitable for different distances.

In the *Journal Télégraphique* the German Government Regulations for the treatment of private messages by wireless telegraphy are published in *extenso*. Regulations of the Telegraph Convention applying to "marine" messages are, as far as possible, to be applied to telegrams by wireless telegraphy, and they may be written in any of the authorised languages. All public offices of the administration are to be open day and night for the receipt of "wireless" telegrams, and various signals are fixed for vessels in distress. Telegrams are to be sent in the following order:—Telegrams from ships in distress, State telegrams, service telegrams, urgent and ordinary private telegrams, and specimen telegrams are quoted. They appear to be very exhaustive.

The Dutch military authorities are, at the present time, making manœuvre trials with portable stations, and if they are found satisfactory a number of military stations will be ordered for their colonies. Several stations of 180 km. range have already been ordered. The place of erection is at present unknown; presumably they are required for warships in the Dutch East Indies.

Two large Turkish stations—viz., Rhodos in Asia Minor and Derna in North Africa, are nearing completion, and will most likely be taken into operation in a few weeks, although great difficulty has been experienced on account of the lack of a sufficiently experienced staff.

(*Continued on page* 594.)

HASTINGS ELECTRIC TRAMWAYS.

The tramway system which has just been opened by the Hastings and District Tramways Co. is one of the most important on the south coast. The scheme embraces two main routes:—(1) A circular route through Baldslow and Ore, with branches to Hollington and the old town of Hastings respectively; and (2) a line along the front through St. Leonards to Bexhill. The first route is now in operation, but some little time will elapse before the line is completed to Bexhill, although the permanent way beyond St. Leonards is now in course of construction and a considerable length has been completed.

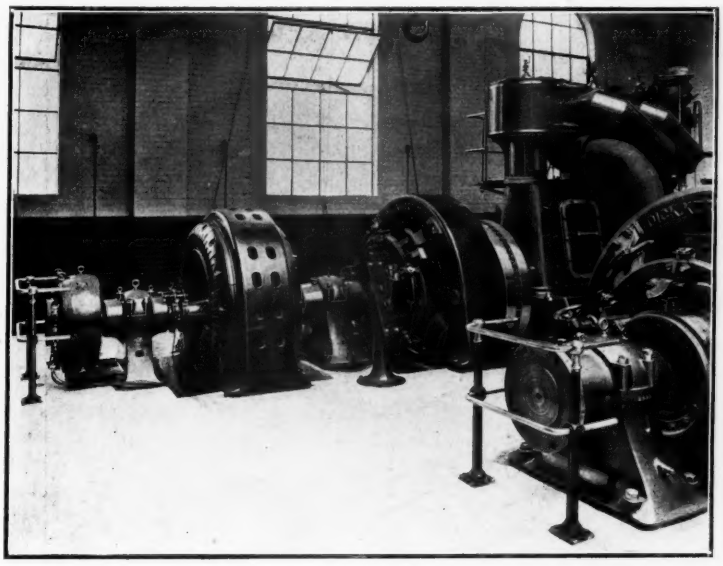


Fig. 1.—View of Combined A.C. and D.C. Steam Generating Set.

The main portion of the system is of normal construction, but a section of the route towards Bexhill leaves the main road and crosses the fields by means of a tram road, 30 ft. in width and about 5 furlongs long, which has been constructed by the company. When complete the system will be some 30 miles in extent; it is designed to serve the needs of a large permanent population, and should be much appreciated also by the numerous visitors to Hastings and Bexhill.

The contractors for the whole of the work were Messrs. Dick, Kerr & Co., Ltd., and the consulting engineers for the scheme were Messrs. Kincaid, Waller, Manville & Dawson.

It is obvious from a consideration of the routes shown on the map (fig. 11) that the system necessitated high-tension transmission with sub-stations.

At the power house, alternating current is generated at a pressure of 6,600 volts, and transmitted to the sub-stations for transformation to direct current at 500 volts pressure. One sub-station erected at Silverhill is now in complete working order, and the second one at Bulverhythe is nearly completed.

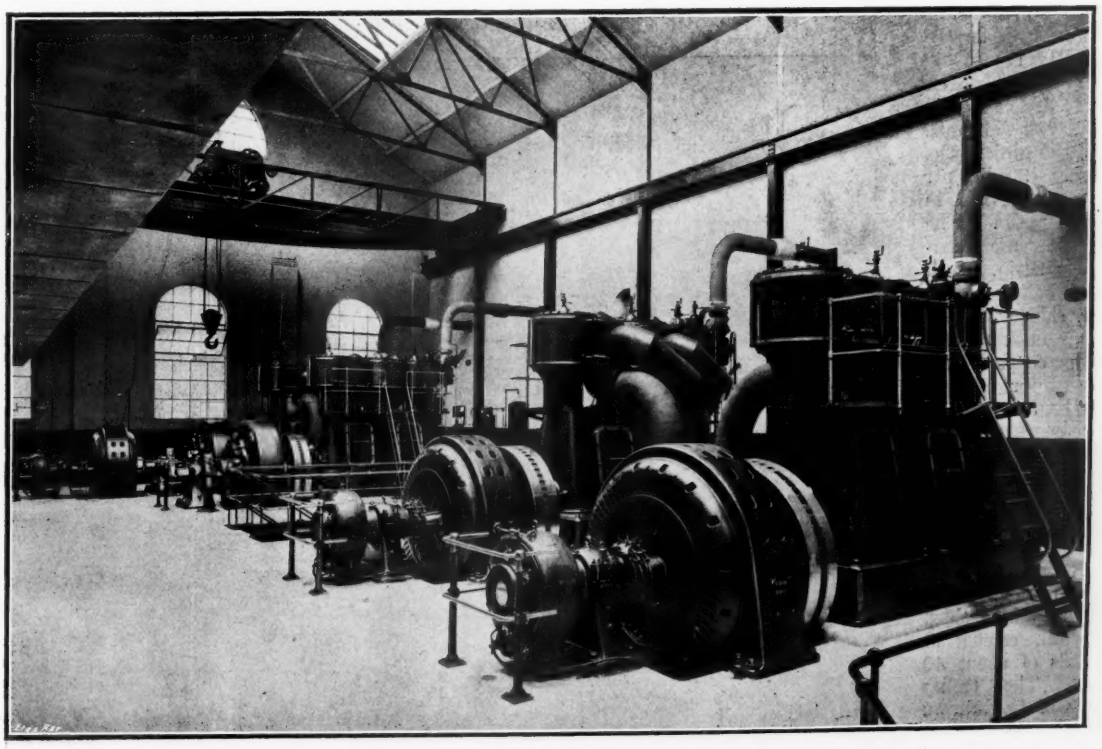


Fig. 2.—General View of the Engine Room showing Belliss-Dick, Kerr Generating Plant.

The total length of tramways now in operation is approximately 16 miles of single track, laid to a gauge of 3 ft. 6 in. The form of track construction mostly used is macadam with granite sett edging, the rails and setts

being laid on a 6-in. bed of Portland cement concrete. In cases, however, where traffic is heavy, the roadway between the rails and for an average space of 18 in. on either side of both double and single track, is paved with granite. On a part of the route near the centre of the town, wood-paving has been adopted throughout. The section across country, on the Bexhill route, is constructed with sleepers and ballasted to rail level. The rails are of the girder type, weighing 90 lb. per yard, and are laid in 45-ft. lengths. The rail joints are fortified by a 24-in. length of rail, bolted on the under side and embedded in concrete; Neptune copper bonds are used for bonding throughout.

Fig. 3.—View of the Silver Hill Sub-station Plant, Showing Rotaries and Switchgear.

The construction of the overhead lines is carried out generally on the side-pole system, with bracket arms and flexible suspensions. The poles are made up in three sections of lap-welded mild-steel, erected at intervals of about 40 yards. The trolley wire is of hard-drawn copper, 4/0 S.W.G., with a diameter of ·400 in., and a breaking strain of 22 tons per sq. in.; the trolley line, following standard practice, is sectioned at every half mile. The extra high-pressure feeders are composed of three-core paper-insulated cable, lead-covered and armoured with steel wire, each cable being laid in a separate trough and run in solid with bitumen. The low-pressure cables are insulated with vulcanised bitumen, and are also laid solid in troughs; the whole of the feeder cables were supplied by Messrs. Callender's Co.

The power station has been erected on a site in Ore Valley, Hastings, adjoining the Ore station of the South-Eastern Railway, and a siding has been provided to facilitate the supply of fuel. The steam-raising plant consists of three Babcock and Wilcox patent marine water-tube boilers, constructed for a working pressure of 180 lb. per sq. in.

Each boiler is capable of evaporating 14,000 lb. of water per hour into high pressure, superheated steam with natural draught.

The steam superheaters—also of Babcock & Wilcox make—are designed to give an increased temperature of 120° F.

The gases and products of combustion are carried through a main horizontal steel flue, supported above and behind the boilers, into a steel chimney 8 ft. in diameter, and 175 ft. high. The flue and chimney have been designed to admit of extensions to the boiler plant when necessary.

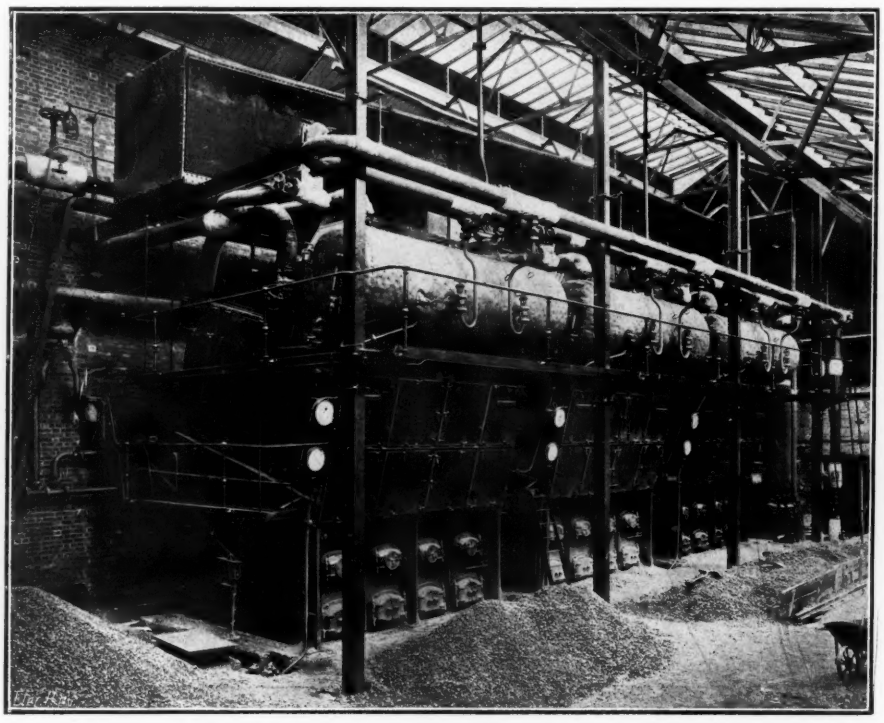


Fig. 4.—Babcock & Wilcox Marine Boilers at the Power Station.

Two of Messrs. J. P. Hall & Sons' direct-acting steam pumps, which supply the boiler feed, are housed in a

pump room, and as each pump is capable under normal circumstances of dealing with from 30,000 to 40,000 lb. of water hourly, there is ample provision for reserve.

The pipe arrangement has been designed to give security against accident, and continuity of supply. The main steam pipe, 8 in. diameter, is of solid drawn mild steel, arranged on the "ring" system; the "ring" is sectioned by means of through-way valves, and arranged vertically upon the boiler house wall, adjacent to the engine room. A 5-in. branch pipe, provided with an isolating valve, connects each boiler to the lower half of the steam ring, while each of the four engine branch pipes is connected to the upper half of the ring main. Each section of the steam main has its own draining pocket, and a separate pocket is provided at each end of the ring to intercept any water which might be carried over, on its way to the engines. It is hardly necessary to add that all these pockets are fitted with automatic apparatus for the instant clearance of such water as may reach them.

An auxiliary steam ring is provided, through which steam is supplied to the feed pumps, condensing engine and other auxiliaries, the small ring being a miniature of the larger one. The branch pipes to the auxiliaries from the secondary ring are all of solid-drawn copper, with flanges of gun-metal, brazed on. The bodies and covers of the valves are of Siemens-Martin acid-process cast-steel, and those on the main ring are provided with by-pass valves to facilitate their operation. The pipes are all covered with a composition containing 85 per cent. of magnesia, suitably wired, and covered with plastic material and canvas.

The exhaust steam from the engines is dealt with by an Allen surface condensing plant, which has been erected in the basement of the engine room. The pumps are driven by means of a vertical compound enclosed high-speed steam engine, the circulating pump being coupled direct, while the air pumps are driven through a single reduction gear. The condenser will deal with about 30,000 lb. of steam per hour, producing a vacuum to within about 4 in. of the barometric pressure. The air pumps are of the two-throw, vertical, single-acting "Edwards" pattern.

The circulating pump is of the centrifugal type, and is capable of delivering the requisite circulating water to the distributing troughs inside the cooling tower, which is of the Klein Co.'s usual standard construction. This pump runs at a speed of 425 r.p.m.

The air pump discharge is delivered, by means of a small pump driven by the same engine, to a filtering apparatus, which clears it of oil and other deleterious matter, when it again passes to the feed pumps.

The filtering plant is constructed upon the Davis Perrett system, which combines an electrical treatment of the water with a filter of the Wilson automatic self-cleaning type, as supplied and made by Messrs. Masson Scott and Co. In this process the condensed water is treated in wooden tanks, in which metallic electrodes are arranged to cause the water to circulate from inlet to outlet; in its passage it is subjected to the action of an electric current, with the result that the emulsive character of the oily water is destroyed, the oil forming a flocculent precipitate, with the oxides of the metal, which can be easily removed by a simple filter. A direct current at a pressure of about 500 volts is used, the tanks being supported upon insulators carried upon an overhead platform within the boiler room, and just above

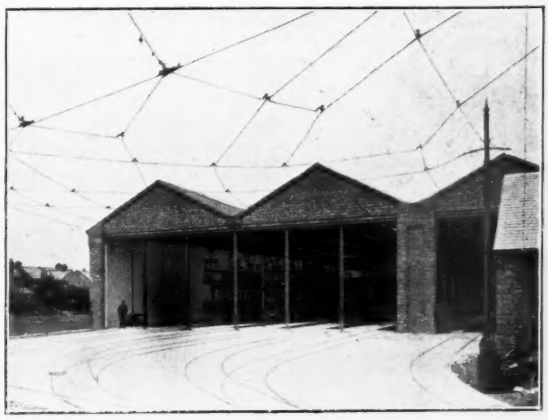


Fig. 5.—The Car-Shed at Silver Hill.

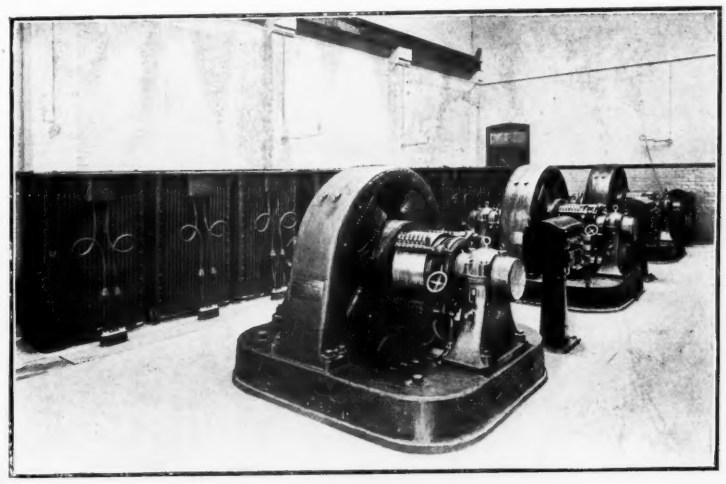


Fig. 6.—Silver Hill Sub-station: Transformers.

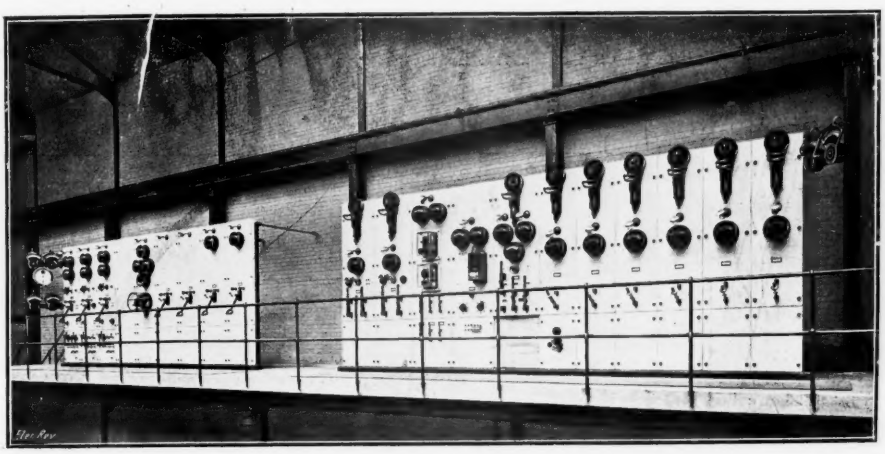


Fig. 7.—View of the Main Switchboard, at the Power Station.

Fig. 8.—View on the Route: Mount Pleasant Road.

the pump room. A galvanised wrought-iron tank having a capacity of 1,000 gallons is installed for the reception of the clean water from the filter, and this tank acts as a hot well from which the boiler feed is taken, and into it the make-up water is supplied from the feed storage tank.

The engines are four in number, of the well-known "Belliss" 3-crank, triple-expansion type, provided with forced lubrication. Each engine is capable of giving a normal output of 540 B.H.P. when running at a speed of 375 r.p.m. condensing or non-condensing, with a steam pressure of 175 lb. per sq. in. at the stop valve.

The generating plant (figs. 1 and 2) consists of three Dick, Kerr standard alternators and two of the same firm's standard direct current generators.

Two alternators and one D.C. generator are each direct-coupled separately to a "Belliss" engine, the fourth engine drives an alternator and D.C. generator coupled together, so as to form a reserve in case of the breakdown of either an A.C. or a D.C. unit. The alternators generate three-phase current at a pressure of 6,600 volts, 25 cycles, each machine being provided with a direct-driven exciter mounted on an extension of the alternator shaft; they are constructed for a continuous output of 300 KW., and will sustain an overload of 25 per cent. for one hour, with a moderate rise in temperature.

The three alternators are designed to run in parallel with each other, means being provided for raising their voltage up to 6,600, when running at a constant speed, to compensate for loss in the mains. The rotor spiders are of cast-iron, of a very strong design, and the pole-pieces are made of laminated steel; the removal of the field coils is effected by sliding a pole-piece from a dove-tailed groove in the rotor, parallel to the shaft, without disturbing any other part of the machine. The design and shape of the pole-pieces produces an approximately sinusoidal shaped wave of E.M.F. The stator frame is built in two halves; the coils which are former wound and embedded in rectangular slots, are held in position by wooden wedges.

The direct current machines are designed to give an output of 300 KW. at a pressure of 500-550 volts when running at 375 r.p.m. The generators are in every respect in accordance with the firm's standard practice; the magnet frame is of cast-iron, the pole-pieces being built of laminated steel and cast into the magnet frame. The commutation is sparkless at all loads, and the field windings are arranged to give a 10 per cent. rise in the E.M.F. from no load to full load.

The switchboard contains 20 marble panels, including three A.C. generator panels, one A.C. spare generator panel, one A.C. total output panel, four A.C. outgoing feeder panels, two D.C. generator panels, one D.C. total output panel, one B. of T. panel, one negative booster panel, and six D.C. feeder panels.

Fig. 9.—On the Battle Road.

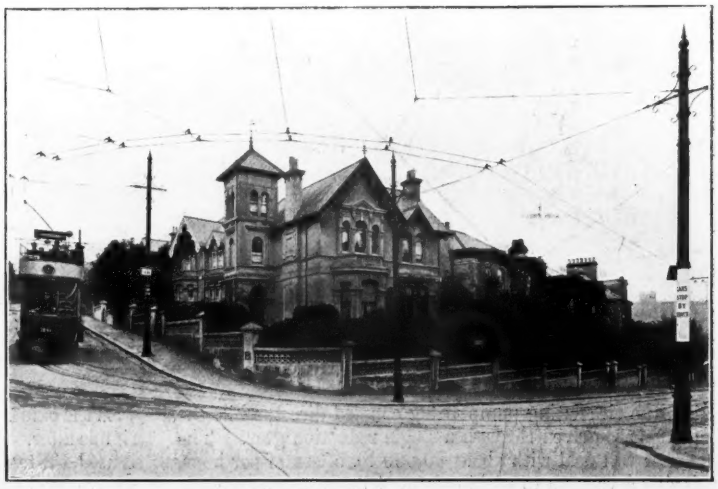


Fig. 10.—The Laton Road Curve.

The whole of the E.H.T. oil switches are contained in a special chamber beneath the main switchboard gallery, each switch being isolated in a separate cell, the front of which is closed by a sheet-iron door. The switches are mechanically operated from the main switchboard gallery, on which no instruments or switches carry current at high pressure.

The sub-stations (figs. 3 and 6) are fed from the power station through Callender's three-core E.H.T. lead-covered cables. At the Silverhill sub-station there are three Dick, Kerr standard 200-KW. compound-wound rotary converters, running at 750 r.p.m., and generating direct current at 500-550 volts. Each rotary has its complement of three single-phase, oil-cooled, step-down transformers. The rotaries are capable of dealing with an overload of 25 per cent. for one hour. The Bulverhythe sub-station is similar to that at Silverhill, and is equipped with the same number of rotaries, with the necessary transformers and switch-gear. The transformers, which are 70 KW. size, are mesh-connected and transform the current from a pressure of 6,600 to 540 volts. The secondary coils are insulated from the iron by mica insulation and oil-proof material; the high-tension coils, outside the secondary coils, being insulated in the same manner. Special circulating ducts are provided for the free circulation of the oil between the iron and secondary, and secondary and primary windings, in order that the core and windings may be thoroughly cooled.

Two car-sheds have been constructed; the principal depôt (fig. 5), situated at Silverhill, has six tracks, and will accommodate 36 cars; the other-car shed is in course of construction at Bulverhythe. A well-equipped repair shop has been provided in the former depôt.

The rolling stock is of the double-deck, single-truck (non-reversed) staircase type, with a seating capacity of 20 inside and 22 outside; 30 cars are in use, and 10 more almost ready for delivery. The cars have all the latest improvements in the way of ventilation and finish; the bodies were built for Dick, Kerr & Co. by the United Electric Car Co., of Preston. They are mounted on Brill 21E type trucks, and fitted with a complete standard equipment, consisting of two 6A type traction motors and controllers of the DB1 form E type, with the patent metallic shield blow-out. Each controller is provided with a "run-back preventer," which makes it absolutely impossible for the car to run away down hill; the movement of the handle to the "off" position short-circuits the motors, in consequence of which there could be only a slow reverse movement of the car. The cars are fitted with lifeguards of the Tidswell pattern, and with the Waller folding steps.

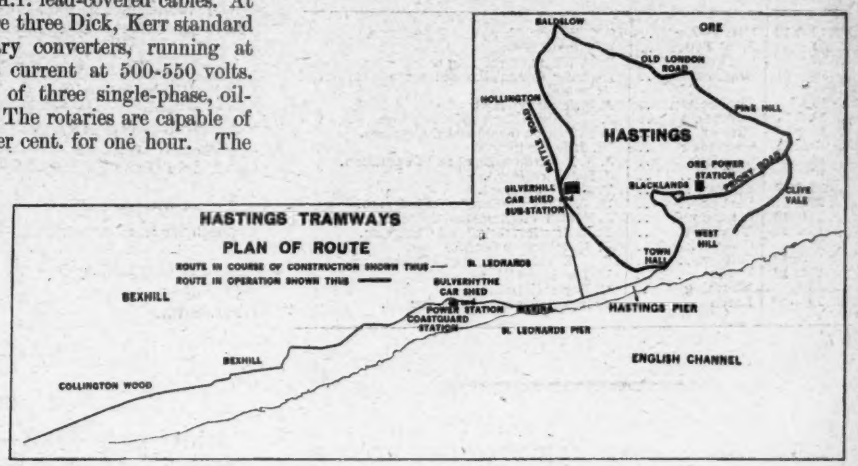


FIG. 11.—PLAN OF THE HASTINGS-ST. LEONARDS-BEXHILL TRAMWAYS.

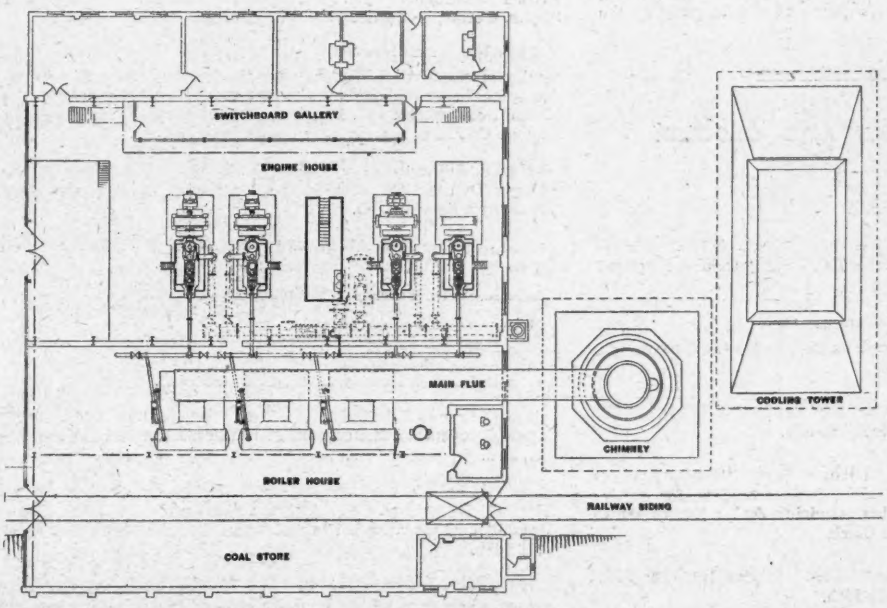


FIG. 12.—PLAN OF THE HASTINGS TRAMWAYS POWER STATION.

On Tuesday we, in company with other representatives of the technical Press, were invited by Messrs. Dick, Kerr and Co. to view the system just described. Luckily the day was in our favour, and the trip over the circular route proved delightfully exhilarating. When the opponents of the scheme persuaded the Harley Street medicos to give evidence against it, and to threaten that they would send their patients to some rival seaside place if the tramways were persisted in, the professors of the healing art knew not what they did.

The best medicine for an invalid fairly on the road to recovery, would be a daily trip on the circular route, which goes out to within two miles of Battle Abbey, through charming roads, and all along the track, which rises high above the town, there can be seen on either side the most exquisite pictures of seascape and landscape. In all directions there is something to please the eye, and the sense of mental satisfaction could but react beneficially upon one's physical state.

Hills are here, there and everywhere, and some of them are so steep that only electrical propulsion is competent to negotiate them at a good rate of speed. Messrs. Dick, Kerr & Co. have carried out many installations of electric tramways, but we doubt if they can point to a more creditable piece of work in the whole country, than the latest example of their constructive ability at Hastings. But what an ideal line for regenerative control!

Wimbledon Lighting.—A L.G.B. inquiry was held on the 6th inst. into the application of the T.C. to borrow £5,000 for E.L. purposes during the 12 months ending March 31st next. There was no opposition.

MUNICIPAL VISITS TO OLYMPIA.

The following is a list of visits that are to be paid to the Electrical Exhibition during next week. The 21st is closing day.—

Probable date of visit.	Coming from	Name of Deputation.
Oct. 12 & 13	Manchester ..	S. L. Pearce (Eng.) and Committee.
,, 13	Long Eaton ..	F. Worrall (Eng.).
,, 13	Blackburn ..	P. P. Wheelwright (Eng.).
,, 13	Brighton ..	Lighting Committee and some Members of Council.
,, 13	Cleckheaton ..	A. Pickersgill (Eng.).
,, 13 & 14	Devonport ..	J. W. Spark (Eng.) and Chairman.
,, 13 or 14	Chester	S. E. Britton (Eng.) and Deputation.
,, 13 or 14	Gloucester ..	W. J. Bache (Eng.).
,, 14	Greenock ..	J. A. Robertson (Eng.) and Deputation.
,, 16	Perth	J. Lambert (Eng.).
,, 16 & 17	Bangor	P. F. White (Eng.).
,, 16 or 17	Partick	H. B. Maxwell (Eng.) and Chairman.
,, 16 to 18	Sunderland ..	J. F. C. Snell (Eng.) and Deputation.
,, 16 to 18	Mansfield ..	E. H. Hewlett (Eng.) and Chairman.
,, 17	Greenock ..	J. A. Robertson (Eng.).
,, 17 or 18	Shipley	S. D. Schofield (Eng.) and Deputation.
,, 17 to 19	Leeds	H. Dickinson (Eng.).
,, 18	Worthing ..	G. Porter (Eng.).
,, 19	Leeds	Alderman Matheson (Chairman).

TELEGRAPH AND TELEPHONE NOTES.

(*Concluded from page* 588.)

Telephone Rates.—A movement has been set on foot by the Plymouth Corporation, to induce other municipalities to take joint action with a view to obtaining a reduction in the telephone charges.

Thames Valley.—At the meeting on Monday of the Thames Conservancy, a complaint was received with regard to the obstruction caused by the telephone wires over the river at Bourne End, stating that sailing boats could not pass without lowering their booms. The chief inspector reported that the wires were placed in their present position in May last, that their height was only about 24 ft., and that they were an obstruction to navigation. It was decided to give notice to the National Telephone Co. to remove the wires within seven days, and that, failing compliance, the work be carried out at the expense of the company by the engineer.

CONTRACTS OPEN AND CLOSED.

OPEN.

Bournemouth.—October 16th. Two passenger lifts on the East and West Cliffs for the T.C. See "Official Notices" September 29th.

Bridlington.—November 1st. One 200-kw. steam dynamo, pipework and switchboard extensions for the Corporation. See "Official Notices" October 6th.

Edinburgh.—October 23rd. Arc lamps and posts for the Corporation. See "Official Notices" to-day.

Enniscorthy.—October 18th. The Committee of Management of the District Asylum invites tenders for sundry electric appliances (including lamps, wiring, &c.), a list of which can be had on application to the Clerk.

G. W. Railway.—October 16th. Stores for one year. See "Official Notices" September 29th.

Heston and Isleworth.—Coal for six months for the U.D.C. See "Official Notices" to-day.

London.—October 25th. Wiring and fittings for the electric lighting of the Bandstand in Victoria Embankment Gardens for the L.C.C. See "Official Notices" October 6th.

Mussoorie (India).—October 23rd. Supply and erection of steel power pipes, water motors, alternators with exciters, switchboards complete, transformers, induction motors, pumps, workshop machines; also bare copper overhead mains, insulators, and lightning arresters, arc and incandescent lamps, telephone equipment, workshop tools and general stores. See "Official Notices" July 14th.

Norwich.—The N.E.T. Co. invites tenders for the right to advertise on its tramway carriages. See "Official Notices" to-day.

Roumania.—Tenders are at present being invited by the municipal authorities of Tulcea for the concession for the electric lighting of the town.

Stoke-upon-Trent.—November 1st. Re-wiring portion of the Workhouse and Cottage Homes, and replating the battery, for the Guardians. See "Official Notices" to-day.

Spain.—November 27th. The Spanish Ministry of Public Works is inviting tenders until November 27th, for the construction of an electric tramway in Madrid, from the Ronda de Valencia to the Glorieta del Puente de Toledo. Particulars may be obtained from, and tenders are to be sent to, La Direccion General de Obras Publicas, Madrid.

Tynemouth.—November 2nd. One 165-kw. traction dynamo for the Corporation. See "Official Notices" to-day.

Worksop.—October 18th. One 36-kw. steam balancer, and one water softener for the U.D.C. See "Official Notices" October 6th.

CLOSED.

Ashton-under-Lyne.—In this column last week we stated that the contract for the superheaters for this place had been placed with Messrs. W. B. Haigh & Co., Ltd., of Oldham. We understand that this firm represents Messrs. T. Sugden, Ltd., in the Lancashire and Yorkshire district, and that the contract is for Sugden superheaters. Messrs. Sugden have recently booked orders for superheaters for the following Corporation Electricity Works:—Erith (repeat order), Birmingham, Plymouth, Swindon, Cardiff and Dartford.

Barnsley.—The Borough Education Committee has accepted the tender of Mr. Hy. Wainwright for the installation of the electric light at Doncaster Road Schools, at £120.

Battersea.—The B.C. has accepted the tender of the Municipal Appliances Co., at £60, to supply to the electricity undertaking one bitumen boiler of 600 gallons capacity.

Bradford.—The T.C. has accepted the tender of the British Westinghouse Co. for the supply of three equipments of 35-h.p. motors, controllers, and other accessories, at £185 each.

Brighton.—The T.C. on October 5th accepted the tender of the British Westinghouse Co. for the supply of cast-iron facias for the switchboards at the Southwick power station and the North Road works, at £100, and that of the Chloride Electrical Storage Co., Ltd., for a battery booster, at £763.

Dewsbury.—The T.C. has accepted the tender of the Phœnix Dynamo Co., of Bradford, for the supply of a booster for the electric light station.

Glasgow.—The Tramways Committee has recommended for acceptance the following offers:—

Scrap special track work, P. & W. M'Lellan, Ltd.
Insulated cable, India-Rubber and Gutta-Percha Telegraph Works Co.
Machine dies, Albert Herbert, Ltd.
Pneumatic power hammers, Messrs. B. & S. Massey.
Trolley standards, Messrs. Estler Bros.
Trolley poles, Messrs. Estler Bros.
Graphite bushings, Messrs. Fleming, Birkby & Goodall.

Ilford.—The Corporation has placed an order for six top-deck covers for tramcars with the Brush Electrical Engineering Co., Ltd.

Leeds.—The Corporation has accepted the tender of the Horsfall Destructor Co., Ltd., for the supply of two cells of Horsfall's patent "tub-fed" type at the Beckett Street destructor, at £2,419.

London.—The London County Council on Tuesday passed the report of the Highways Committee in reference to the acceptance of tenders for the supply of (1) car-bodies for 150 electric cars, (2) trucks for the cars, and (3) equipment for the cars and fitting them together. The tenders are as follows:—

1.—Car-Bodies.

	Price per car.	Total price (150 cars).
Hungarian Railway Carriage and Machine Works ..	£388 0	£58,200
Hurst, Nelson & Co., Ltd. .. .. .. (accepted)	423 10	63,525
Brush Electrical Engineering Co.	494 10	74,175
United Electric Car Co.	499 0	74,850
Metropolitan Amalgamated Railway Carriage and Wagon Co.	502 10	75,375
St. Louis Car Co., U.S.A.	505 0	75,750

The lowest tender did not comply with the specification, and the company were also not prepared to accept the Council's labour conditions.

2.—Trucks.

	Price per pair of trucks for one car.	Total price (150 cars).
Hungarian Railway Carriage Works	£92 0	£13,800
Brush Electrical Engineering Co.	96 0	14,400
" " " alternative tender	116 0	17,400
United Electric Car Co.	99 10	14,925
" " .. alternative tender	119 10	17,925
Hurst, Nelson & Co.	112 0	16,800
Mountain & Gibson .. .. .. (accepted)	120 0	18,000
" " .. .. alternative tender	122 0	18,250
" " .. .. " "	125 0	18,750
" " .. .. " "	131 0	19,650
Peckham Manufacturing Co., U.S.A.	140 0	21,000
H. T. Bradford, London	160 0	24,000

The Highways Committee, in reporting upon the tenders for trucks, stated that it was of great importance that the trucks should be of reliable and satisfactory design, as, under the conditions now obtaining with the use of roof covers and the additional load due to the increased number of passengers thereby carried, it was very necessary for the trucks to bear without injury the increased strain thus put upon them. It had been found in the past that a very heavy item in the expenditure due to repairs of cars had been in respect of the trucks, and, in these circumstances, it had been essential to examine very carefully the designs submitted by the firms who had forwarded tenders. As a result, the tender of Mountain & Gibson, as shown above, has been accepted.

3.—Electrical Equipment and Assembly of Cars.

	Price per equipment for one car.	Price per erection of one car.	Total price (150 cars).
British Westinghouse Co. (accepted)	£280 13 4	£8 0	£43,300
British Thomson-Houston Co. ..	293 13 4	9 10	45,475
Dick, Kerr & Co..	293 13 4	10 0	45,550
Brush Electrical Engineering Co. ..	353 13 4	20 0	56,050

4.—Laying of Cable Ducts.

Reid Bros., London .. (accepted)	£31,132	6 3
Muirhead, Greig & Matthews	32,307	15 6
Westminster Construction Co.	33,282	12 4
J. A. Ewart, London	34,276	12 7
British Insulated and Helsby Cables ..	39,000	5 6
J. Mowlem & Co.	40,380	0 0
Stephen Kavanagh & Co.	41,267	2 3
James F. Cummings & Co.	42,812	17 8
Cunningham, Forbes & Co.	69,712	15 6

The successful firm has been authorised to sub-let the carting work in connection with the contract.

Newport (Mon.).—The tender of Messrs. Templer and Raynor for supply of grease separator in connection with the extension of plant at the power station, at £96 10s., has been accepted, and that of Messrs. W. A. Baker & Co., Ltd., at £140, for the extension of a flue.

Pontypridd.—The D.C. has accepted the tender of Messrs. Krauss & Co. for the permanent way of the Rhondda route, at £20,586.

Port Elizabeth.—The Lighting Committee, having considered the tenders received for installing the electric light and telephones in the central station, recommended the tender of Messrs. W. Bellad Ellis & Co. for acceptance.

Salford.—The T.C. on October 4th accepted the following tenders in connection with the electricity and tramways departments:—

Mr. Bertram Thomas, Manchester, reverse current circuit-breaker.
British Westinghouse Co., Ltd., mechanical car accessories.
Messrs. W. T. Glover & Co., Ltd., paper-insulated and high and low tension cables.
Howard Conduit Co., Ltd., asphalte troughing.
General Electric Co., Ltd., carbons for arc lamps, electric fittings and steel insulated screwed tubing.
Royce, Ltd., electric motors and motor starters.
Chamberlain & Hookham, Ltd., electricity meters.
Tudor Accumulator Co., Ltd., repairs, &c., to two batteries and 10 years' maintenance.

Shanghai (China).—Messrs. D. Bruce Peebles & Co., have secured the complete contract for electric tramways here, including 30 miles of track, overhead work and cables, power station plant, and 100 cars and equipment. The total value of the contract is £377,000.

Stafford.—The T.C. has accepted the tender of the Tudor Accumulator Co., Ltd., for the supply of a storage battery of 210 cells and ten years' maintenance.

Southwark.—The B.C. received the following tenders for the supply of a balancer booster and switchboard:—

British Westinghouse Electric Manufacturing Co., Ltd., £582.
Mather & Platt, Ltd. (accepted), £618.
General Electric Co., Ltd., £640.
Chloride Electrical Storage Co., Ltd., £645.
Siemens Bros., Ltd., £667.
Lancashire Dynamo Co., Ltd., £685.
Electric Construction Co., Ltd., £1,038.

For a feed-water heater and softening plant the following tenders were received:—

Patterson Engineering Co., Ltd. (accepted), £365.
Lassen & Hjort, £395.
H. T. Wright Bros., Ltd., £425.
Erith Engineering Co., Ltd., £495.
Worthington Pump Co., £574.
James Simpson & Co., Ltd., £629.
William Boby, £640.

Worcestershire.—Messrs. Lea & Warren, Kettering, have placed the order for a battery of 128 21-plate cells for Barnsley Hall Asylum with Messrs. Pritchetts & Gold, Ltd.

FORTHCOMING EVENTS.

To-day's Events.—At 8 p.m. At Olympia. Lecture on "Electric Telegraphs," by Mr. A. Martin.

Saturday, October 14th.—At 2 p.m. North of England Institute of Mining and Mechanical Engineers. Meeting at Wood Memorial Hall, Newcastle-on-Tyne.

At 7.30 p.m. Birmingham and District Electric Club. At the Colonnade Hotel. Topical discussions on "Gas *v.* Electricity," "Alternating *v.* D.C. Motors," "Copper *v.* Carbon Brushes," "Water-Tube *v.* Lancashire Boilers," "Suction *v.* Town Gas for Power Purposes."

Tuesday, October 17th.—At 8 p.m. Lecture at Olympia on "Electric Arc Lighting," by Mr. Frank Bailey.

Wednesday, October 18th—At 4 p.m. Junior Institution of Engineers. Visit to Electrical Exhibition, Olympia.

Thursday, October 19th.—At 8 p.m. Rugby Engineering Society. Paper on "Switchgear," by Mr. J. Whitcher.

Friday, October 20th.—First Smoking Concert of the Electro-Harmonic Society. At 8 p.m. Lecture at Olympia on "Telephones," by Mr. F. Gill.

Saturday, October 21st.—At 7.30 p.m. Glasgow Technical College Scientific Society. Dr. H. Dyer on "The Training and Work of Engineers in Some of their Wider Aspects."

Friday, October 27th.—At 6.30 p.m. Institution of Electrical Engineers (Glasgow). Fourth Annual Dinner at the Grosvenor Restaurant.

Tuesday, November 7th.—At 8 p.m. Institution of Civil Engineers. Inaugural Address by the President, Sir Alexander R. Binnie. Presentation of the Council's Awards, and Reception in the Library.

THE ELECTRICAL ENGINEERS R.E. (VOLS.).

The following orders are issued:—

Monday, October 16th.—Headquarters re-opens from this date for Corps' business, from 10 a.m. to 10 p.m.
Friday, October 20th.—The parade for the Woolwich detachment ordered for 13th is cancelled, and will now take place on 20th inst. Parade at R.A.M.C.(V.) Hall, Brook Hill Road, 8 p.m. Uniform to be worn if possible Working dress in forage caps without arms. Recruiting will be carried out

Wilfrid C. Dumble, Captain R.E.
For O.C.E.E.R.E. (V.)

NOTES.

Wheels on the Brooklyn Elevated.—Although mention of it has been delayed for so long, an article on wheels in the *Street Railway Review*, for May, is too important to ignore. The subject matter was supplied from the records of the Elevated Division of the Boston Elevated Co. Naturally, the experience gained in this service cannot be taken as it stands for application to tramway working, but much of it is of value to any interested in wheels run on rails. Steel tired wheels are used throughout, as we might expect from the nature of the service, for the cars weigh 29½ tons light and 36 tons loaded, run up to 40 m.p.h., and have to negotiate innumerable curves of short radius.

So severe are the conditions, indeed, that each tire has to be ground about every two weeks, "the daily average number of tires ground being 48 pairs in 10 hours." With all this the life of a tire averages 2½ to 3 years, running from 106,000 to 198,000 miles, and the article is concerned chiefly with the workmanlike means which have been adopted for performing the work of grinding expeditiously and with the least waste of material.

It is very evident that the records of the maintenance department have been kept extraordinarily well, and with considerable attention to detail. Probably the long average life, the improved appliances, and the modifications in design, have been due in no small measure to these records, and we have little doubt that the extension of shop and office work to include the manufacture of statistics from raw material would help towards providing that depreciation fund from which the majority of tramways excuse themselves. Motor wheels are 34 in., trailer wheels 31 in. in diameter when new, and the permitted wear reduces each to 30 in. and 27½ in. respectively.

It is found to be economical to grind the tires at short intervals, as the amount of metal removed is less in the long run when compared with grinding at longer intervals, and the trains are less noisy when flats are not allowed to develop. Tires are shrunk on and further held by retaining rings which are riveted to the sides. The average *circumferential* wear per 1,000 miles is ·0781 in., on which basis the average life works out at 147,700 miles, while the *net* cost comes to 25d. (49 cents) per 1,000 miles. The size of the trailer wheels has been so nicely chosen that their tires wear almost the same length of time as the motor-wheel tires.

The Boston Elevated cannot afford broken axles, nor do they risk them if the following test is carried out as stated:—"A pneumatic pressure of 25 tons is applied at the centre of each motor axle and the deflection recorded on a gauge. . . . If there is any permanent deflection . . . the axle is rejected." That test is applied to new axles and every two months thereafter.

The writer always tested axles every time a car was overhauled, and whenever wheels were to be pressed on, but that was done by compressing the axle lengthways in the wheel-press up to 30 or 40 tons per sq. in. The minutest flaw, even a superficial crack, can be detected immediately in this manner. Solid gear-wheels are used on the Boston Elevated. They are keyed as well as pressed on.

Testing Rubber Gloves.—An expert in the manufacture of rubber gloves for electricians informs us that while testing with water is a good way of finding imperfectly made joints, it is of no use for discovering defects in material, such as grit or air bubbles below the surface. These are quickly found by a high voltage test with alternating current in water, without which test the use of the gloves may be more dangerous than their neglect.

Every pair of gloves should be certified to have passed an A.C. test at 5,000 or 10,000 volts, according to the requirements; it is useless to test a sample pair, where human life is at stake, and every engineer purchasing such gloves should insist on an adequate guarantee of their reliability as stated above.

Electro-Harmonic Concert.—The first smoking concert of the Electro-Harmonic Society, as already announced, will be held on Friday next at the King's Hall, Holborn Restaurant, at 8 p.m. The chair will be taken by Mr. W. Worby Beaumont. The programme includes vocal music by Messrs. Fred Norcup and Harry Dearth; instrumental music will be rendered by Mr. T. E. Gatehouse (violin) and Mr. A. E. Izard (piano). Mr. Charles Capper will give whistling solos; Mr. Will Edwards, humorous songs; Mr. W. H. Owen, humorous recitations; and Mr. Harrison Hill is to give some of his humorous sketches. It is hoped that there will be a large gathering to give the 1905-6 season a good send-off.

London County Council.—The Council re-assembled on Tuesday, when sanction was given to the borrowing by the Islington B.C. of £13,000 for electric lighting extensions, and of £10,223 by the Woolwich B.C. for lighting works in Shooter's Hill and Eltham. A further loan of £16,275 to the latter Council for the laying of mains was postponed for a week. The question of applying to Parliament in the next session for powers to construct several lengths of tramway, at a total cost of £414,160, was postponed for a week. The Highways Committee, in referring to the feeder pillars erected on the footpaths along the routes of the tramways, expressed the opinion that in order to avoid any risk of the pillars becoming charged with electricity, it would be advisable to connect the outer iron cases to earth. It was estimated that the cost of thus connecting the 58 pillars already in use would amount to £150, and the Council sanctioned the expenditure for this purpose. It was further stated by the committee that the expenditure during the year 1904-5 had in two instances exceeded the estimates approved by the Council in May, 1904. The chief excess occurred in the working of additional car services, mainly from the Bankside temporary station. The expenditure under that head amounted to £368,759, or £51,089 more than the vote of £317,670 approved for the purpose, but the extra receipts more than covered the additional expenses. The second excess was one of £822, and was due to unforeseen general expenses.

Electrical Dinner at the Electrical Exhibition.—On Monday last the Executive Committee of the Electrical Exhibition entertained the electrical and lay Press at a dinner cooked by electricity. The hall was heated and lighted with electricity, and the strains of the electrical piano—to say nothing of electrical hooters, electric bells, electric motors and electric sparks—were dimly audible without. To say that the dinner was done to an ampere-turn would be to do the barest justice to its merits and to the art of Mrs. Deane, who, we note, is certificated in magnetism and electricity. The guests signified their approval in the usual way, their admittance being limited only by their capacity, and their load factor varying as their reluctance to switch off. During the repast numerous ammeters were observed round the horse-shoe table, and several electrical magnates were present.

The chairman, Mr. E. Cunliffe Owen, proposed the loyal toasts, and afterwards stated that the meter had been read before and after cooking the meal, and showed that 56 units had been consumed. There were 65 guests. During the past week or two, some of the London supply companies, he said, had reduced their charge for heating and cooking to 1d. per unit, so that the cost for energy at this rate would have been 4s. 8d. He questioned whether coal, coke, gas or oil could have been employed at the same cost. As the Crystal Palace Exhibition of 1890 had popularised electric lighting, so, he hoped, the Olympia Exhibition would convince the public that electric cooking was not only the best but also the cheapest means of cooking. Electric radiators also had a great future. The freedom from discomfort, even in the elevated gallery of the Exhibition, in spite of the myriads of lamps burning in the hall, was perfect—let them try to imagine what the atmosphere would have been like if gas had been used. They could afford to smile at the alleged "victories" of gas. There were the equivalent of 4½ million 8-C.P. electric lamps in use in London at the end of last year, and the number connected was increasing faster than ever before. The Exhibition had already proved a greater success than had ever been anticipated; last Saturday 14,000 persons visited the show. The exhibitors were well pleased with the results. Lastly, the depression in trade seemed to be passing away. The Chairman then requested the guests to spend a little while in the Exhibition, and the company dispersed by degrees, well pleased. Many tarried to inspect the cooking apparatus, which was provided by the Dowsing Radiant Heat Co., Ltd.; the British Prometheus Co., Ltd.; the Electric Heating Co.; the General Electric Co., Ltd.; and Messrs. Veritys, Ltd.

Sanatoria for Tuberculosis.—We have been asked to draw attention to the appeal which is being made to the public with a view to the establishment of self-supporting sanatoria for the treatment of consumption among the working classes, and we have great pleasure in supporting this worthy object. The ravages of this disease, though they have been reduced by 50 per cent. during the past half century, are still appalling, and seeing that, according to a recent statement, it is one of the most curable of diseases—*if taken in time*—it is obviously of the first importance that every facility should be provided for the prompt and effectual treatment of those who are without means to secure it unaided. No one can plead that he is not deeply interested in this question: it is one of vital national importance. An influential committee has been formed, with H.R.H. Princess Christian as president, and a meeting will be held in the Memorial Hall, Farringdon Street, on November 18th, to which the mayors of the various towns of the United Kingdom will be invited. Mr. E. D. White, of 19, South Molton Street, Bond Street, London, is the secretary, from whom full particulars can be obtained.

Olympian Lectures.—Mr. J. Swinburne lectured on "Domestic Lighting" on Friday last, dealing with the evolution of the glow lamp and its modern rivals, as well as with the cost of electric lighting and its numerous advantages. A variety of lamps were exhibited and their virtues explained.

On Tuesday last Mr. S. Z. de Ferranti lectured on the subject of "Electricity Meters." He first explained the ordinary gas meter, and showed that, unlike gas, electricity was capable of being measured in many ways; and that although inventors had worked all along these different ways, practice had shown that an electric motor meter, which approached closely to the gas meter idea, was the most practical form. Mr. Ferranti then showed his audience his first electricity meter of the motor type which he had made and used commercially in 1884, and also other meters of his, of the same type and date which, with slight modifications, were now in use in nearly one hundred thousand houses. He next dealt with the improvements made by Mr. Hookham, showing examples of his earliest meters dating back to 1887. Many other meters were shown and explained by means of diagrams and experimental apparatus. In concluding, the lecturer expressed the opinion that in the future the motor type of meter in its simplest form would be the one almost entirely used, and that with these motors the greatest accuracy was now the rule.

On Wednesday evening Mr. H. J. Dowsing lectured on the subject of "Electric Heating." Mr. Dowsing, who first introduced this method of producing warmth to the general public at the Crystal Palace Exhibition in 1883, went thoroughly into the question of electric radiators, explaining their many advantages in the way of portability, cleanliness, localisation of heat, &c., and also touched upon the uses of electricity for welding and smelting, light baths, light or heat rays, and other medical applications. Concluding with a dissertation on electric cooking, which, perhaps, is the direction in which most interest is being displayed at the present time, Mr. Dowsing showed by means of plain figures what advantages this method of culinary preparation claimed over all others.

Gas.—Four cases of fires in London on Saturday were traced to escapes and explosions of gas.—*Daily Telegraph.*

It is reported that on the morning of 10th inst., two householders in Aston had narrow escapes from gas suffocation. Leakages in the main caused gas to accumulate in the houses, with the result that many occupants were rendered unconscious while in their beds. At Sheffield on the same morning, five persons in one house were sufferers from a similar cause.

Institution Notes and Lectures.—A lecture on the "Care of Motors and Electrical Machinery in Printing Works" was given by Mr H. Marryat (Marryat & Place), at the Aldenham Institute, Goldington Crescent, Pancras Road, N.W., on 25th ult., on the occasion of the inauguration of the new session of the letterpress printing classes.

At Leeds, on 3rd inst., Prof. G. R. Thompson delivered the inaugural lecture in connection with the Department of Mining of the University of Leeds, his subject being "Some Recent Electrical Accidents in Mines."

Yesterday afternoon a visit was to be paid to the Underground Electric Railway Co.'s generating station at Lot's Road by members of the Institute of Sanitary Engineers.

At the Engineering Laboratory of Liverpool University, on 10th inst., Prof. W. H. Watkinson, the newly-appointed Professor of Engineering, delivered his first public lecture there, the subject being "Steam Turbines."

Aberdeen Mechanical Society.—At the annual meeting on the 6th inst., a discussion was introduced by Mr. James Hunter, vice-president of the society, on the subject "Is the Steam Engine to become Obsolete?"

Society of Engineers.—At a meeting held at the Royal United Service Institution, Whitehall, on Monday, October 2nd, a paper was read on "Machine Drills for Hard Rock," by Mr. Arthur H. Smith.

Electrolytic Manufacture of Persulphates.—A French patent has been taken out by the "Consortium für Electrochemische Industrie" for a process of preparing the persulphates of potassium and sodium. There is said to be no particular difficulty in obtaining ammonium persulphate; but the production of the potassium and sodium salts is more troublesome, partly because the sulphates of the respective metals are so much less soluble in water than the corresponding ammonium compound that only weak solutions can be submitted to electrolysis, but principally because anodic oxidation is less energetic (especially in the case of sodium

sulphate) than when ammonium sulphate is under treatment. The yield of persulphate increases with rises in potential at the anode; and the potential can be increased by adding hydrofluoric or hydrochloric acid to the bath, *i.e.*, by the introduction of the specially active ions Fl, Cl, ClO_4, Cl_2O_7, &c. If a concentrated solution of potassium bisulphate is electrolysed at a temperature of 15° with a current density of 0·15 ampere per square centimetre, the current efficiency of the operation ranges from 40 to 50 per cent.; but it can be increased to 60, 69, 77 and 80 per cent. by adding 1, 5, 10 and 20 per cent. by volume of hydrofluoric acid to the bath. After the electrolysis has continued for some time, the anode potential falls, and the yield of persulphate decreases. This is due to the formation of Caro's acid, which is produced more copiously as the electrolyte becomes more acid. For example, when a saturated solution of bisulphate and sodium persulphate is electrolysed at 15° C., the amount of Caro's acid formed in 24 hours may be about 0·3 per cent.; but in presence of 10 per cent. of sulphuric acid, the yield during the same period of time will be 0·6 per cent. By the employment of a reducing agent, however, the Caro's acid may be decomposed as quickly as it is formed. The new process is, therefore, carried out in the following typical fashion: 25 litres of saturated bisulpbate solution are mixed with 125 grammes of sodium perchlorate, and electrolysed at a temperature of 15° C. with a current of 25 amperes. In 24 hours' time the liquid will contain 0·3 per cent. of Caro's acid, which is equivalent to a formation of 3 grammes of $NaSO_5$ per hour. The liquid is therefore treated with 4 cc. of 40 per cent. hydrochloric acid every hour. By working in this manner, the yield of sodium persulphate is equal to 68 per cent. of the theoretical amount at the beginning of the operation, and is 63 per cent. after the expiry of eight days.

Electro-Therapeutics in America.—The fifteenth annual meeting of the American Electro-Therapeutic Association was held at the Academy of Medicine, New York City, on September 19th and 21st. Medical men from all parts of the United States attended in large numbers, and some very interesting papers were read, showing that a very considerable advance had been made with the use of the various forms of electricity in its application for the prevention and cure of disease.

Dr. Williams James Morton, of New York, read a paper on the "Preparation of Radio-Active Water," in which he pointed out the simplicity of obtaining it by merely placing 10 lb. of pitchblende in about 2 gallons of water; after two weeks the water was strongly radio-active, and his experience proved its therapeutic value. Dr. George B. Massey, Philadelphia, on "Methods in the Treatment of Operable Cases of Cancer," proved that electricity could be used with more advantage than was generally supposed. For the early stages he recommended mercuric cataphoresis, for advanced stages the knife, and for cancers difficult of access the X-rays. Dr. Amédée Granger, New Orleans, in a long paper on "Clinical and Experimental Study of the Action of Mercuric Cataphoresis in the Treatment of Cancer," gave his experience in using currents varying from 200 to 700 milliamperes—the treatment lasting in some cases an hour and 40 minutes—and related many cases in which he applied the treatment identified with Dr. Massey's name. Dr. E. C. Titus on "The Action of Röntgen Rays and Light upon the Engynies," showed from his experiments on vegetable seeds, hens' eggs, &c., the therapeutic action of the rays in certain diseases and the great value of sunlight. Some 30 other papers all went to show that the use of electricity with regard to the more serious diseases was daily gaining ground.

The Berlin Lock-Out.—The latest news to hand as we go to press regarding the Berlin electrical strike, is to the effect that the representatives of the employés of the electrical firms have been informed by the directors that the masters adhere to the concessions already proffered to the men, but cannot grant anything further. The strikers are given until this afternoon to decide whether they will resume work on these conditions. In the event of their accepting the ultimatum the lock-out will be at once withdrawn and the works reopened.

A New Australian Electrical Association.—An influential gathering of electrical men was held in Melbourne towards the end of August with the object of forming a Victorian Electrical Association. A provisional committee was appointed to prepare rules to be submitted to a later meeting.

Smoke Prosecution.—Were it not so pitiable an exhibition of the folly of attempting the impossible, the attempts to stop the Neasden smoke nuisance would be somewhat of a comic opera. The railway company and the Westinghouse Co. were fined last week for long-continued smoke emission, and we hear from residents in the district that the outpouring of black smoke has been terrific. It appears that two makes of mechanical stoker have already been tried under the boilers, under the long-exploded idea that a mechanical stoker can prevent smoke. Now a trial is being given to a third stoker—the chain-grate, which, with a long arch over the grate and excessive air admission, will do something to reduce the nuisance at considerable loss of economy in the utilisation of the coal.

The plain English of the whole American fiasco is that the boilers are badly set to begin with, and it is being attempted to carry out the combustion of English coal in furnaces that were designed originally for absolutely smokeless American anthracite. Need it be wondered at that, as always has happened, and always will happen, with this American setting, there has been an intolerable smoke? The chairman of the bench of magistrates considered it very humiliating to the engineers concerned that they had failed in all they had done to abate the nuisance. To our way of thinking, the humiliation comes not in failing to make a success of an impossible form of furnace, but in the initial mistake of putting in what every engineer should have known must fail. Possibly, the companies concerned, by wasting a portion of their coal, may be able, by aid of the newly adopted stokers, to abate the smoke to a considerable extent, but they would have been better advised had they boldly replanned their boiler settings in accordance with correct principles.

Since it is known that smoke is unnecessary and can be prevented by the proper form of furnace, is it not time in all cases that the fuller powers of the law were invoked to compel proper furnaces to be installed?

The Olympian Motor Show.—The fourth motor exhibition of the Society of Motor Manufacturers and Traders is to be held at Olympia on November 17th. It will be larger than that held last February. The number of exhibitors will be 250, of whom 104 will show motor-cars, 35 will exhibit commercial motor exhibits, 26 will show motor-boats, and the remainder will exhibit carriage work, tires, accessories, and machinery.—*The Times.*

Appointments Vacant.—Junior shift engineer for Partick (20s.); shift engineer for Middlesbrough (35s.); a superintendent of drawing offices and workshops is wanted for Battersea Polytechnic (£225); car-shed and rolling stock superintendent for Johannesburg municipal tramways (£40 per month).

The Liége Exhibition.—The *Times* Brussels correspondent says that this Exhibition, which closes at the end of the present month, has fully satisfied the expectations of its promotors. Up to the present the attendance has exceeded 6,000,000, while the receipts have totalled about 2¼ million of francs.

Behaviour of Magnesium as an Anodic Material.—G. Baborovsky has recently published in a Russian journal an account of his experiments upon the behaviour of metallic magnesium when used as an anode. When aqueous solutions of chlorides, sulphates, &c., are electrolysed, hydrogen is evolved both at the cathode and at the anode; and at the latter a black substance, formerly regarded by Beetz and Elsässer as a sub-oxide, is deposited. Magnesium anodes pass into solution at a constant electrode potential of 1·3 volts, irrespective of the current density, temperature, concentration and composition of the electrolyte, and the black substance in question is always produced. Presumably, therefore, it is a sub-oxide having the formula Mg_3O_2. It can, however, only be isolated in a highly hydrated condition, and direct attempts to prepare a body of that composition have not been successful. Probably such a sub-oxide is produced during electrolysis in the first instance, but it suffers decomposition afterwards into a mixture of metal and ordinary oxide. The electrode potential of magnesium anodes in neutral solutions is fairly constant, and has almost the same value as that shown by a freshly and heavily amalgamated surface of magnesium immersed in aqueous solutions without current. The electrode potential of amalgamated magnesium is higher than Naumann's figure, and also higher than the potential shown by a bare magnesium surface in solutions of magnesium chloride or sulphate. All these electrode potentials fall quickly, and are independent of the concentration of the magnesium ions. In solutions of sodium, potassium and barium hydroxide, magnesium anodes dissolve very slightly, practically pure oxygen is evolved on their surfaces, and various phenomena of passivity are to be observed. In alkaline solutions three different conditions can be plainly distinguished as existing upon the surfaces of magnesium anodes: the original state, the passive state and the active state. These pass readily from one to the other. In the passive state the anodes are luminous, and the solution potential reaches a high value owing to the low conducting power of the layer upon the anode, which renders it passive. The electrode potential of a magnesium anode in an alkali hydroxide solution is lower than in a neutral liquid, but is capable of the same changes. In a mixed solution of potassium chloride and hydroxide, semi-normal in strength in respect of the chloride, and normal in respect of the hydroxide, hydrogen and oxygen are evolved from magnesium anodes simultaneously. Both actions are local. In neutral solutions magnesium anodes cause potassium permanganate to be reduced to manganate, and iodidion to be oxidised to I_2; in alkaline solutions promidion and iodidion are oxidised to BrO_3 and IO_3 ions respectively, permanganate is reduced to manganate, and chloridion remains unchanged.

OUR PERSONAL COLUMN.

[*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.*]

Central Station Engineers.—Mr. R. W. Grubb, assistant electrical engineer for the Borough of Swindon, has been appointed deputy captain of the Swindon Fire Brigade.

Mr. John J. Gowan, of Cork electric power station, has been appointed junior assistant at Limerick Municipal Electricity Works. There were 44 applicants.

Mr. A. G. Livesay, assistant electrical engineer to the Leeds Corporation tramway department, having secured an appointment under the British Westinghouse Co., at Manchester, has been presented by the employés of the department at Leeds with a handsome chiming clock. Mr. J. B. Hamilton, the general manager, made the presentation. Mr. A. W. Maley has been appointed successor to Mr. Livesay. He has been connected with the department ever since the introduction of the electric tramways into Leeds.

The Port Elizabeth T.C. recently left to the town engineer the suggested appointment of Mr. S. H. Barber as chief assistant at the electricity works.

The Swindon T.C. on October 4th, by 18 votes to 10, rejected a recommendation that the salary of the electrical engineer (Mr. J. G. Griffin) should be increased from £300 to £325 per annum.

The members of the staff at the Frederick Road station, Pendleton, Salford, have presented a music cabinet and stool to Mr. J. W. Hair, chief draughtsman, on his marriage. Mr. C. D. Taite, borough electrical engineer, made the presentation.

Mr. Lawton has resigned his position as clerk of the works under the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board, and has been granted an honorarium of £20 for extra services rendered.

The Electric Power Committee has recommended Devonport T.C. to increase the salary of Mr. Spark from £275 to £300 per annum, and that of Mr. Stamp from £140 to £150.

At the last Bournemouth T.C. meeting Mr. Bulfin, borough electrical engineer, reported that Mr. F. O. J. Roose had been appointed assistant resident engineer under the London County Council, and that he proposed to appoint Mr. H. G. Andrews to Mr. Roose's position, and Mr. Keene to Mr. Andrews's position; also to appoint Mr. J. H. Chick, of Acton, as shift engineer, at the usual salary of £104, rising by annual increments of £5 to £120. Those appointments were ratified by the Council.

General.—We understand that Mr. A. Eckstein, who has been connected with the General Electric Co. for the last 18 years, and since the formation of the company in 1900, has held the position of managing director and head of the Manchester factories and supply house at Victoria Bridge, will terminate his connection with the company on October 15th. Mr. Eckstein has not yet finally settled upon his future work, but as he has been connected all his life with electrical manufacturing, we shall no doubt hear of him in that capacity again.

The *Financial News* says that Mr. W. E. L. Gaine (manager of the National Telephone Co.), Mr. F. Gill (the company's chief engineer), Mr. J. Gavey (engineer-in-chief of the Post Office), and Mr. Andrew Ogilvie (assistant secretary to the Post Office), arrived at Liverpool on 11th inst.-from New York. They went to America to study the telephone system there, in view of the taking over of the company's business by the Government. It is understood that they will report against a change in the present telephone charges.

A Chelmsford paper says that Mr. R. F. Hayward, formerly of the Arc Works, Chelmsford, and chief electrical engineer at the Utah Light and Railway Co. for the past 11 years, has been appointed manager of the Mexican Light and Power Co., Ltd., City of Mexico. Before leaving Salt Lake City, Utah, Mr. Hayward was the recipient of a beautiful silver punch bowl from the officers and employés of the company.

It is reported in one of the daily papers that Sir William Mulock, the Canadian Postmaster-General, intends to retire from the Government. "It is likely that he will be replaced by Mr. Aylesworth."

Mr. N. Gunz has resigned his position as secretary of the General Electric Co., Ltd., and has established himself as manufacturer's agent at 46, Queen Victoria Street, E.C.

Mr. R. Stewart Bain has resigned his seat on the board of the National Electric Construction Co., Ltd.

A unique gathering took place at the Hotel de Bâle, Hatton Garden, on Saturday evening (October 7th), when a score of the old boys who were at Scott's Engineering Works in 1888 and 1889 met together, mostly for the first time, after an interval of 16 years. There were present:—Messrs. F. Armfield, E. S. Davidson, E. Eberwein, R. J. Elmhurst, F. N. Haward, Jackson, A. B. Lillywhite, H. Marryat, E. G. Moyes, E. L. Pinching, W. M. Rogerson (Halifax), C. N. Russell (Shoreditch), H. Sadd, J. R. Smith, H. Squire (Chelsea), C. E. W. Talbot, W. C. Thomson, W. E. Toy and J. Watts. Letters and telegrams of regret at unavoidable absence were received from Messrs. B. Arkell, C. D. Asprey, J. H. Garratt (Colombo), A. J. Hodgson, L. A. Jinks, E. C. Patey, H. A. Place, C. E. Tickner and Tubbs. The function, which was of an informal nature, was voted a complete success, and by the time fish appeared everyone felt himself to be 16 years or so younger. During the concert which followed, voices were found to have improved with years, but each retained its old peculiarities of expression, which carried one back to the old days more than anything else. Mr. Russell, who was referred to as "Father," made the speech of the evening, and won great applause, whilst no more hearty toast was drank than that of "Good Old Sadd." A proposal to make the re-union an annual affair was carried by acclamation, and another proposal to repeat the function before the close of the present year was received with favour, and will be carried out if possible. Mr. H. Marryat, of 28, Hatton Garden, E.C., was appointed hon. secretary, and will be glad to receive the addresses of old boys whose names do not appear in the above report. Amongst those particularly wanted are Messrs. Johnson and Cook (better known as "Jubilee").

Mr. Charles Gorick has left the General Electric Co., Ltd., and taken up the position of general manager to the Amalgamated Dry Batteries, Ltd., whose London offices are at 16 and 17, Devonshire Square, E.C.

Obituary.—Mr. William B. Rankine, second vice-president of the Niagara Falls Power Co., died in Franconia, N.H., on Saturday, September 30th, in his 48th year. He went to Franconia on August 12th, accompanied by Mrs. Rankine, on a vacation. He was in good health until a week before he died, when he took cold, and congestion of the lungs followed, death resulting. No man was better known in the field of the Niagara power development than Mr. Rankine. It was mainly through his efforts that capital was enlisted for the present project of the Niagara Falls Power Co. as well as the Canadian Niagara Power Co. For nearly 20 years his entire effort had been devoted to this development. It was while Mr. Rankine was a resident of New York that several Niagara Falls gentlemen conceived the ambition to begin the development of Niagara power on a large scale. They sought out Mr. Rankine in New York, soliciting his aid in getting capital to back the project. Negotiations extended over several years, but by 1890 the company was fully capitalised and the work begun. Since that time Mr. Rankine had devoted his time to the interests of the power development. At the time of his death he was a director of the Ramapo Ironworks; second vice-president of the Niagara Falls Power Company; vice-president of the Canadian Niagara Power Company; second vice-president of the Niagara Junction Railway, holding a similar position with the Niagara Development Company; secretary-treasurer of the Cataract Power and Conduit Co.; director of the Tonawanda Power Co.; secretary of the Tesla Co.; director of the Bell Telephone Co.; director of the Niagara Tachometer and Instrument Co.; director of the Niagara Research Laboratories; and so on. Our Niagara correspondent says that the death of Mr. Rankine is considered a very great loss to the industrial interests of Western New York and the Province of Ontario. Out of respect for his memory, the Common Council of Niagara Falls directed that the flags on all city buildings be displayed at half-staff for a period of 30 days, and that all city offices be closed on the day of the funeral.

Sir E. H. Carbutt.—We regret having to record the death of Sir Edward Hamer Carbutt, which occurred somewhat suddenly at his residence at Cranleigh, near Guildford, on Sunday night. He was 68 years of age, and since 1861 he had been more or less prominently associated with engineering. The *Times*, in its account of his career, states that he was the representative of the Institution of Mechanical Engineers in the National Physical Laboratory, and of the Iron and Steel Institute on Sir W. H. White's Committee to formulate a scheme of education for engineers. Sir E. H. Carbutt had taken part in most of the International exhibitions since 1862, and was a member of the Royal Commission appointed for the last French exhibition. He was a past president of the Institution of Mechanical Engineers, a member of the Institution of Civil Engineers, and a vice-president and one of the original members of the Iron and Steel Institute. He took an active part in the recent meeting of the Iron and Steel Institute at Sheffield. He was created a baronet in 1892. He leaves no heir, and the baronetcy becomes extinct.

NEW COMPANIES REGISTERED.

Improved Electric Supplies, Ltd. (86,014).—This company was registered on October 2nd, with a capital of £15,000 in £1 shares (5,000 7½ per cent. cumulative preference, 5,000 ordinary, and 5,000 "B"), to acquire and take over the business formerly carried on by the Improved Electric Glow Lamp Co., Ltd., to adopt an agreement with W. Chamberlain, and to carry on the business of electricians, mechanical and electrical engineers, electro-platers, manufacturers of, agents for and dealers in electric lamps, fittings, plant, tools and apparatus used in the employment of electricity, &c. The first subscribers (each with one share) are:—W. Chamberlain, Pendock Grove, Cobham, manufacturer; H. Lewis, 12-13, Nicholas Lane, E.C., manager; H. H. Thompson, 7, Great Newport Street, W.C., secretary; J. W. Miles, 27, King Street, Cheapside, E.C., solicitor; A. Hair, 27, King Street, Cheapside, E.C., solicitor; A. Cleveland, St. Michael's House, Basinghall Street, E.C., accountant; and J. G. Turner, 27, Rectory Road, Parson's Green, Fulham, S.W., clerk. No initial public issue. The number of directors is not to be less than two nor more than five; the first are W. C. Chamberlain, H. H. Thompson, and A. Cleveland; qualification (except A. Cleveland), £200 shares; remuneration as fixed by the company. Registered office: 7, Great Newport Street, W.C.

Foreign and Colonial Concessions, Ltd. (86,002).—This company was registered on September 30th, with a capital of £5,000 in £1 shares to apply to and obtain from any Colonial or foreign Government or authority concessions for the construction and working of any railway, light railway, tramway, canal, harbour, port, gas, water or electric power or light undertaking, and to develop and turn to account the same. The first subscribers (each with 10 shares) are:—W. Brown, 17, Victoria Street, S.W., engineer; J. Griffiths, 65, Dyne Road, Brondesbury, N.W., gem merchant; A. McGechie, 199, Gresham House, E.C., F.C.S.I.; C. Waitham, The Croft, Gomshall, gentleman; D. W. McGechie, 13, Queensland Avenue, Highgate, gentleman; Lord Danvers, 1, Broad St. Place, E.C.; and G. N. Fell, 17, Victoria Street, S.W., civil engineer. No initial public issue. The number of directors is not to be less than three nor more than five; the signatories are to appoint the first; qualification, one share.

Sol Manufacturing Co., Ltd. (86,006).—This company was registered on September 30th, with a capital of £1,500 in £1 shares, to carry on the business of manufacturers of and dealers in dry cell batteries and electrical appliances. The first subscribers (each with one share) are:—P. H. Bohanna, Waratah House, Clapham, S.W., importer; Mrs. E. J. Bohanna, Waratah House, Clapham, S.W.; T. Mason, 48, Torrington Square, W.C., merchant; Mrs. M. E. Mason, 48, Torrington Square, W.C.; A. S. Bohanna, Waratah House, Clapham, S.W., importer; W. Jackson, Colonial House, Tooley Street, S.E., merchant; and H. Mason, 5, The Wrythe, Carshalton, Surrey, gentleman. No initial public issue. The number of directors is not to be less than two nor more than five; the first are P. H. Bohanna, H. Mason, T. Mason, and A. S. Bohanna. Registered office: 28, Marshalsea Road, S.E.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Lowden Electric Lamp Co., Ltd. (Watford), (83,470).—A debenture dated September 22nd, 1905, to secure £100, charged on the company's undertaking and property, present and future, has been registered. Holder: F. N. Bell, 3, Campden Hill Square, Holland Park, W.

Johnson & Phillips, Ltd. (Electrical Engineers, Old Charlton and London), (84,968).—A trust deed dated September 28th, and an instrument of charge under the Land Transfer Acts, 1875 and 1897, and dated September 27th, 1905, securing £175,000 debenture stock, have been registered. Property charged (by trust deed): Freehold and leasehold property, rights and other assets, present and future, including uncalled capital (if any). (By instrument of charge): Freehold hereditaments comprised in titles No. 114,544 and 114,391, and leasehold hereditaments in title No. 114,576. Trustees: London and General Investment Trust, Ltd., 12, Moorgate Street, E.C.

White, Jacoby & Co., Ltd. (52,494).—This company's annual return was filed on September 27th, when 3,207 shares had been taken up out of a nominal capital of £4,000 in £1 shares; £850 has been received, and £2,357 is considered as paid. Mortgages and charges: £1,500.

Ackroyd & Best, Ltd. (54,600).—This company's annual return was filed on September 13th, when 2,241 preference and 1,800 deferred shares had been taken up out of a nominal capital of £25,000 in 3,200 preference and 1,800 deferred shares of £5 each; £5 per share has been called up on the preference and £11,205 has been received; 1,800 deferred shares are considered as fully paid. Debentures allotted and sealed, £19,300; debentures applied for but not allotted and sealed, £1,000; floating debentures to cover bank and guarantors of bank overdraft, £3,500.

N. S. Electric Storage Co., Ltd., London (75,623.)—Issue on September 18th of a debenture for £1,000, part of series created August 10th, 1905, to secure £20,000, charged on the company's undertaking and property, present and future. No trustees. Previously issued of same series: £1,800.

County of London Electric Supply Co., Ltd. (34,320.)—This company's annual return was filed on August 9th, when 30,000 preference 40,000 ordinary shares had been taken up out of a nominal capital of £1,600,000 in 80,000 preference and 80,000 ordinary shares of £10 each. £10 per share has been called up, and £700,000 has been received. Mortgages and charges: £800,000. [A copy of an Act of Parliament (Royal Assent, August 4th, 1905) authorising the company to purchase lands, construct generating stations, &c., was filed on September 27th.]

Newtons, Ltd. (48,936).—This company's annual return was filed on September 26th, when 3,265 shares had been taken up out of a nominal capital of £40,000 in 4,000 shares of £10 each. £10 per share has been called up on 1,865, and £18,650 has been received. 1,400 shares are considered as fully paid. Mortgages and charges: £10,000.

South American Cable Co., Ltd. (34,363).—This company's annual return was filed on August 8th, 1905, when 24,707 shares had been taken up out of a nominal capital of £500,000 in 50,000 shares of £10 each. £10 per share has been called up on 14,707, and £147,070 has been received. 10,000 shares are considered as fully paid. No mortgages or charges.

Exchange Telegraph Co., Ltd. (6,152C).—This company's annual return was filed on September 12th, when 8,023 "A" and 16,500 "B" shares had been taken up (exclusive of forfeited shares) out of a nominal capital of £246,250 in 8,125 "A" and 16,500 "B" shares of £10 each. £9 per share has been called up on 6,000 "A" and £1 per share on 2,023 "B" shares, and £56,023 had been received. £162,000 is considered as paid on 6,000 "A" and 10,000 "B" shares issued as fully paid, and £17,000 on 2,125 "A" issued as partly paid to the extent of £8 per share. 102 of the last-named shares have been forfeited. Mortgages and charges: Nil.

Electrical Oil Refining Co., Ltd. (43,126).—This company's annual return was filed on September 21st, when 4,375 shares had been taken up out of a nominal capital of £5,000 in £1 shares. £1 per share has been called up on 882, and £882 has been received. £3,493 is considered as paid on the remainder. Mortgages and charges: Nil.

Sanitas Electrical Co., Ltd. (72,615).—This company's annual return was filed on October 5th, when 4,250 shares had been taken up out of a nominal capital of £5,000 in 5,000 shares of £1 each; £1 per share has been called up on 2,250, and £2,250 has been received. £2,000 is considered as paid on the remainder. Mortgages and charges: Nil.

Nalder Bros. & Thompson, Ltd. (62,214).—This company's annual return was filed on September 22nd, when 7,846 preference and 11,125 ordinary shares had been taken up out of a nominal capital of £22,500 in 10,000 preference and 12,500 ordinary shares of £1 each; £1 per share has been called up on 7,846 preference and 1,125 ordinary, and £8,971 has been received; £10,000 is considered as paid on 10,000 ordinary. Mortgages and charges: Nil.

Ilfracombe Electric Light and Power Co., Ltd. (71,378).—This company's annual return was filed on July 21st, when 67 shares had been taken up out of a nominal capital of £15,000 in 3,000 shares of £5 each. £5 per share has been called up and £335 has been received. Mortgages and charges: nil.

Conduits and Fittings, Ltd., London (81,348).—£500 debentures, created September 8th and dated September 15th, 1905, charged on the company's undertaking and property, present and future, including uncalled capital, have been registered. No trustees.

CITY NOTES.

British Columbia Electric Railway Co.

The directors' report to be submitted at the meeting to be held at Abercorn Rooms, Liverpool Street Hotel, on Monday next, says that the business shows continued increase and prosperity in all departments. For the 12 months to June 30th, 1905, the gross receipts show an increase over the preceding year of $91,687, and the net earnings, after charging renewals, show an increase of $44,531. The following charges have been made against the revenue account of the year, viz.: Provision for renewals maintenance (from which £8,645 18s. 7d. has been deducted for expenditure on renewals during the year), £16,565; bonus to employés, £3,611; amount written off preliminary and issuing expenses, £1,862; amount added to capital amortisation fund, £1,725. The net profit for the year, after making the above deductions, amounts to £57,877; add balance brought forward from last year, £2,222 = £60,099. Interest on debentures absorbs £13,586, and the interim dividends on 5 per cent. cumulative perpetual preference stock, on preferred ordinary stock, and on deferred ordinary stock amounted to £35,649, leaving available for distribution and reserves £24,451.

From this the directors have decided—

To provide for the dividend on the cumulative perpetual preference stock for six months to June 30th, 1905	£2,875
To provide for the dividend on the preferred ordinary stock for three months to June 30th, 1905	3,750
To recommend the payment of a dividend on the deferred ordinary stock at the rate of 3 per cent., making 6 per cent. for the year, which, including income-tax, will absorb	9,947
To write off the balance of preliminary and issuing expenses, amounting to	1,651
To transfer to reserve fund	4,461

leaving £1,767 to carry forward to next account.

The number of lights in use at June 30th, 1905, was 136,512, an increase of 23,601 over the number in use on June 30th, 1904. The number of passengers carried during the year was 10,352,451, an increase of 1,482,965. During the year £107,446 has been spent in extensions and improvement of the company's property and equipment. A line has been built to the Gorge in Victoria, and a recreation ground covering 10 acres has been laid out at the end of the line. The Gorge extension has proved very popular with the Victoria public and with visiting tourists. In Vancouver a line has been built to Kitsilano (Greers Beach). This line was opened on July 4th, and has since been very largely patronised. A traffic arrangement has been made with the Canadian Pacific Railway Co. in reference to their line built from Vancouver to Steveston, the principal city on Lulu Island and the centre of the salmon fishing industry on the Fraser River. Under the arrangement made, this company has electrified the line, and has operated it since July 4th. The operation is an unqualified success. In pursuance of the company's well-established policy of giving the public the benefit of cheapened cost of production, voluntary reductions have been made during the year in the prices charged for electric light. The Vancouver power installation has been completed during the year and is now in full operation. The directors are much gratified by the success of this very important undertaking, the results of which have exceeded their expectations. The full benefit of this new source of power was not obtained until June 1st, so that the year's accounts are not largely affected by it.

Practically the whole of the share capital of the Victoria Gas Co. has been acquired, and steps are being taken to improve and extend its plant. The results, for the current financial year, of taking over the Vancouver Gas Co. have been entirely satisfactory to the company and have been equally beneficial to the consumers, to whom the charge for gas has been reduced. Mr. F. S. Barnard and the Hon. R. G. Tatlow, M.P.P., have been appointed as an Advisory Committee, resident in British Columbia. Mr. J. Buntzen, who has hitherto acted as general manager in British Columbia with such conspicuous success, has been appointed managing director of the company, and although he will in future reside in England, he will visit British Columbia periodically. Mr. R. H. Sperling, who for a number of years has been the company's general superintendent in British Columbia, has been appointed his successor. Mr. F. Hope, for many years the secretary of the company in England, has been appointed assistant manager in British Columbia. During the early period of the current year, at the suggestion of the British Columbia management, an accountant, in whom the directors have full confidence, was employed to visit British Columbia with wide powers to investigate the company's affairs. His report was of an entirely satisfactory character and quite confirmed all the advices that had been received from British Columbia and the opinions previously formed by the directors. The directors have much pleasure in recording their appreciation of the services of the company's staff in British Columbia and their satisfaction with the excellent relations existing between the company and its employés. The share of profits distributed among the employés for the year amounts to $15,400.

Edison & Swan United Electric Light Co.

The twenty-second annual report for the business year ending June 30th, 1905, reads as follows:—

"The net revenue account shows that the sum of £47,898 0s. 2d. has been brought forward from profit and loss account. Interest on debenture stock has absorbed £18,760 18s. 4d.; £12,000 has been set aside as depreciation on freehold and leasehold property, plant, machinery and tools; £1,552 18s. 5d. has been applied in writing down values of stocks, and the sum of £2,677 3s. 3d. has been reserved on account of bad and doubtful debts. A further sum of £1,000 has been added to the reserve for future stock depreciation. The result, as shown in the net revenue account, is a credit balance of £11,907 0s. 2d., to which must be added the sum of £5,302 2s. 11d. brought forward from the previous year, thus making a total of £17,209 3s. 1d., out of which the directors recommend the payment of a dividend for the year on the "A" shares at the rate of 2½ per cent., amounting to £9,586 19s., leaving a sum of £7,622 4s. 1d. to be carried forward. During the year £43,947 of this company's debenture stocks have been purchased and cancelled, resulting in a profit of £6,970 9s. in addition to that shown above. This amount has been appropriated partially by way of discount on amounts owing by debtors, and partially as a reserve against stock depreciation. Cost of establishing the business, goodwill, &c., £443,451 8s. 1d., has been brought forward at the figure standing in the last balance-sheet. The freehold and leasehold property, plant

and machinery have also been brought forward at the value stated in the last balance-sheet, with the addition of the amount expended to June 30th, 1905, less depreciation charged in net revenue account. There has been expended on capital during the year ending June 30th, 1905, £2,395 16s. 8d. The shares of the Altrincham Electric Supply, Ltd., have been taken at par, as in previous years. This concern continues to show satisfactory progress. Its indebtedness to this company has been reduced during the year by £2,265 8s. 6d."

The following resolution, or a resolution to the like effect, was to be submitted to the meeting yesterday, with a view to its subsequent confirmation as a special resolution:—

That the capital of the company be reduced from £941,090, divided into 150,000 "A" shares of £5 each, 26,436 "B" shares of £5 each, and 23,564 "B" shares of £2 10s. each, to £888,071, divided into 150,000 "A" shares of £5 each, 26,436 "B" shares of £5 each, and 23,564 "B" shares of 5s. each, and that such reduction be effected by cancelling paid-up capital which has been lost, or is unrepresented by available assets, to the extent of £2 5s. per share on each of the 23,564 "B" shares which have been issued and are now outstanding, and by reducing the nominal amount of each of such £23,564 "B" shares to 5s.

Sir J. W. Swan, F.R.S., retires in rotation, and offers himself for re-election.

Cuba Submarine Telegraph Co.

THE directors' report for the half-year ending June 30th, 1905, says that the total receipts of the six months were £16,273, while the expenses amounted to £6,334, leaving a balance of £9,938, to which has to be added £3,093 brought forward from last account, giving a total of £13,032 to be dealt with.

The dividend on the preference shares will absorb £3,000, and leave £10,032, out of which the directors recommend the payment of a dividend at the rate of 5 per cent. per annum on the ordinary shares, free of income tax; the balance, £6,032, being carried forward to the current half-year. The cables continue in good working order.

The claim against the United States Government for payment of the cost of repairing the damage done to the cables during the Spanish American War is still unsettled.

Indo-European Telegraph Co.—The board have declared an interim dividend for the half-year ending June 30th last at the rate of 5 per cent. per annum, free of income-tax, payable on and after November 1st next. The transfer books will be closed from the 18th to the 31st inst., both days inclusive.

Anglo-American Telegraph Co.—The directors have resolved, after placing £5,000 to the credit of the renewal fund, to declare an interim dividend for the quarter ending September 30th, 1905, of 15s. per cent. on the ordinary stock, and £1 10s. per cent. on the preferred stock, less income-tax, payable on November 1st.

Stock Exchange Notices. — The Committee has appointed a special settling day, as under:—

Wednesday, October 18th.—Newcastle and District Electric Lighting Co., Ltd. —£150,000 4½ per cent. Mortgage Debenture stock.
J. Stone & Co., Ltd.—20,000 5 per cent. Cumulative Preference shares of £10 each, fully-paid, Nos. 1 to 20,000; and has ordered same to be quoted officially.

Applications have been made to the Committee to allow the following to be quoted in the Official List:—

Indian Electric Supply and Traction Co., Ltd.—£125,000 6 per cent. Construction Debenture stock.
County of Durham Electrical Power Distribution Co., Ltd.—20,000 5 per cent. Preference shares of £5 each fully paid, Nos. 1 to 20,000.
Electric Supply Corporation, Ltd.—£50,000 4½ per cent. Debenture stock.

Siam Electricity Co.—This company held its thirteenth ordinary general meeting on August 31st, at Bangkok, Engineer-Commander C. Sommer presiding. A dividend of 6 per cent. was declared for the half-year.

Lanarkshire Tramways Co.—This company resolved last week to raise additional capital to meet additional expenditure on the Larkhall extension, by the issue of 5,400 new shares of £10 each.

Milford-on-Sea Electric Light Co. — The second annual meeting of this company was held at the generating station on September 30th, Dr. V. D. Harris presided. The report, in which a dividend of 2½ per cent. was recommended, was adopted. Satisfaction was expressed at the success of the year's working.

Indian Electric Supply and Traction Co.—A meeting of this company was held yesterday at Winchester House, E.C.

Cape Electric Tramways, Ltd.—It is stated in the *Financial Times* that the directors of this company have convened an extraordinary general meeting for the purpose of obtaining authority to raise further capital, not exceeding £200,000, in debentures or debenture stock.

Reuter's Telegram Co.—The directors have declared an interim dividend at the rate of 5 per cent. per annum, tax free, for the half-year ended June 30th.

Eastern Extension, Australasia and China Telegraph Co.—The directors have declared an interim dividend for the quarter ended June 30th of 2s. 6d. per share, free of income-tax.

STOCKS AND SHARES.

Wednesday evening.

WEAKNESS and reaction followed in sharp succession throughout the markets of the Stock Exchange in the early part of this week. A 5 per cent. Bank Rate is the most keenly discussed topic in financial circles, and money again governs most of the markets. Not so—fortunately—as regards the majority of electrical securities, in some of which there is pronounced strength, as may be seen from a rapid glance down the final columns of the following pages.

Our hint of last week with reference to a possible working arrangement between the City of London and the Charing Cross (City Undertaking) Companies is worth recalling in the light of the further improvement in the Ordinary shares of both undertakings. City Lights are now 12; Charing Cross Ordinary are 7½. The Charing Cross City Undertaking has only issued Preference shares to the public so far, and the price of these is not affected. County of London are also a good market, having risen to 9¼, but Metropolitans dropped back to 10½ on the cessation of the buying which recently carried the price over 11. St. James's are firm at 14¼.

Progress continues to be made with the advance in Central London Deferred stock improving to 84½, although the company's other descriptions are inanimate. City and South London Ordinary is 41, and Waterloo and City remains dull at 90. Business has rather fallen off in East London Ordinary, the price still keeping about 5½; attention of speculators is directed more to the prior-charge securities, and the five classes of Debenture stocks are called 93½, 104½, 30, 12½ and 6½. The first named receives 3½ per cent., and the second 4 per cent. There is also a 2½ per cent. Whitechapel Extension Debenture quoted 64½. It may be well not to build too much upon Lord Claud Hamilton's directorial connection with this company and the Great Eastern Railway.

With other railway stocks, Metropolitan Consolidated has weakened, and is no better than 89, after falling to 88½, the next dividend being somewhat a fancy quantity. Those condemned to travel by the District will notice with savage satisfaction that the price of the Ordinary has dwindled to 33¾, with none too much market at that. Great Northern and City Preferred "A" are 5¼. The scrip certificates of Great Northern, Piccadilly and Brompton command ½ premium, and those of its twin, the Charing Cross, Euston and Hampstead, stand at their paid-up price.

Thanks to the excellent report out this week, the British Columbia Electric Railway stocks have hardened substantially, the Deferred to 127½, the Preferred to 110½. The company made £7,300 more in net revenue for 1904-5 than in the preceding year. British Electric Tractions at $9\frac{5}{16}$ have picked up a shade, but the Traction section has little movement to show this week. A contemporary which quotes Kalgoorlie Electric Power Ordinary at 4s. is confusing the shares with those of the Kalgoorlie Tramways Co.—a very different thing. The latter are being sedulously puffed by outside brokers, which in itself is not unsuggestive. The price of the Power Ordinary is about 12s., and the Preference are 19s. 6d. middle. Anglo-Argentine Trams at 8⅜ keep steady, and Belgranos stay at 3⅞. Calcutta Trams and Calcutta Electrics are both the same price, 9½; both, too, are £5 shares, and fully-paid. Cape Electrics declined to $1\frac{5}{16}$ upon the cool suggestion of the directors to take powers for raising £200,000 in Debentures.

Several cable shares have put on fractions in consequence of increased attention directed to the material. British Insulated are 6⅞, and Callender's 11, although India-Rubber, Gutta-Percha, and Henley's shares are without movement. Amongst other manufacturing shares, Edison & Swan continue a good market, and Telegraph Constructions are firm at 35. Westinghouse Preference were done at $2\frac{7}{16}$ the other day.

Telegraph varieties are fairly good, under the leadership of Anglo-Americans, where the market strengthened upon the declaration of a better dividend on the Preferred. Other fluctuations include a drop in Eastern Ordinary to 144½, and improvements of a small degree in West Coast of America, Great Northern Telegraph and Indo-Europeans, although these last have scarcely influenced the nominal quotations. National Telephone stocks eased off a trifle after their improvement, but firmness is noticeable in the shares of the Oriental Telephone and in United River Plate Telephone Debentures.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. †	Dividends for the last four years. 1902.	1903.	1904.	1905.§	Closing Quotations Oct. 4th.	Closing Quotations Oct. 11th.	Business done week ended Oct. 11th, 1905. Highest	Lowest.	Rise + or Fall —
34,800	African Direct Telegraph, 4 % Debs...	100	4 %	4 %	4 %	..	99—102	99 —102	..	..	..
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	3 - 3⅛	3 — 3⅛	..	..	..
119,700‡	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	Nil	Nil	..	82 — 87	82 — 87	..	..	..
763,680	Anglo-American Telegraph	Stock	60/6	61s.	2⅜%	29s.§	61 — 63	61 — 63	61⅛	..	..
3,118,210	Do. do. do. 6 % Pref.	Stock	6 %	6 %	5⅛%	58s.§	108½—109½	109 —110	109⅜	109	+ ⅛
3,118,210	Do. do. do. Deferred	Stock	1/-	2s.	Nil	..	16½ — 17	16⅛ — 16⅞	17	16/16	— ½
44,000	Chili Telephone, Nos. 1 to 44,000	5	6 %	7 %	8 %	..	7⅛ — 7⅜	7⅛ — 7⅜	7 7/32	..	..
1,982,856‡	Commercial Cable Stlng. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	..	97 — 99	97 — 99 xd	98¼	98	..
16,000	Cuba Telegraph	10	6⅓%	10 %	5 %	5 %§	9 — 9¼	9 — 9¼	9 9/32	..	..
6,000	Do. 10 % Pref.	10	10 %	5 %	10 %	10 %§	17½ — 18½	17½ — 18½	..	..	..
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %§	3⅜ — 3⅝xd	3⅜ — 3⅝ xd	..	..	..
6,000	Do. do. 10 % Cum. Pref.	5	10 %	10 %	10 %	10 %§	9¼ — 9½xd	9¼ — 9½ xd	..	..	..
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%§	100 —103	100 —103 %	..	..	..
60,710‡	Direct United States Cable	20	3½%	3 %	3½%	3 %§	11⅞ — 12⅛	12 — 12½	12 1/16	11 15/16	+ ⅛
74,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200,R.	100	4½%	4½%	4½%	..	100 —102	100 —102	..	..	..
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	5 %§	144 —147	143 —146	145½	144	— 1
2,000,000	Do. 3½ % Pref. Stock	100	3½%	3½%	3½%	3½%§	90 — 92	90 — 92	91	..	..
1,836,814	Do. 4 % Mort. Deb. Stock Red.	Stock	4 %	4 %	4 %	4 %§	108 —110	108 —110	..	..	..
300,000	Eastern Extension, Australiasia, and China Tele.	10	7 %	7 %	7 %	6 %§	13⅞— 14½	13⅞ — 14½	14 3/16	13⅞	..
602,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %§	106 —108	106 —108	106½	..	..
300,000	East & S. Afric. Tel., 4 % Mt. Db., 1 to 3,000, red. 1909	100	4 %	4 %	4 %	..	99½—101½	99½—101½	..	..	..
200,000‡	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	..	101½—103½	101½—103¼%	..	..	..
180,887	Globe Telegraph and Trust	10	£3 16	5½%	5⅜%	..	10½— 11	10½ — 11	10⅝	10⅜	..
180,887	Do. do. 6 % Pref.	10	6 %	6 %	6 %	..	14½— 14¾	14½ — 14¾	14 7/16	14¼	..
150,000	Great Northern Telegraph, of Copenhagen	10	12½%	15 %	24 %	..	36 — 37	35½ — 36½	35⅝	35	— ½
46,500	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	..	100 —102	100 —102	..	..	..
17,000	Indo-European Telegraph	25	10 %	10 %	13 %	..	53 — 55	54 — 56	55½	54½	+1
72,680	Monte Video Telephone Co., Ltd. Ord.	1	3 %	3 %	..	..	⅜— ⅞	⅜— ⅞	..	..	..
1,983,333	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %§	112 —113	112 —113	112⅝	112	..
1,966,667	Do. do. Def. Stock	100	4½%	5 %	5 %	5 %§	107 — 109	107 — 109	107⅞	107	..
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %§	13¾— 14½	13¾ — 14½	..	..	..
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %§	12 — 13	12 — 13	..	..	..
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %§	5⅝— 5⅞	5⅝— 5⅞	5¾	5 11/16	..
2,000,000	Do. do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	..	99 —101	99 —101	99⅛	..	..
1,689,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	104½—106½	104½—106½	105⅛	105	..
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid	1	6 %	6½%	6¾%	..	1½— 1⅝	1½— 1⅝	1 5/16	1 5/32	..
50,000	Do. do. do. 6 % Cum. Pref.	1	6 %	6 %	6 %	..	1 7/16— 1 15/16	1 7/16— 1 15/16	1 1/8	..	..
100,000	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	..	100 —103	100 —103	..	..	..
11,839‡	Reuter's	8	5 %	5 %	5 %	5 %§	8 — 8½	8 — 8½	8⅜	7½	..
3,237	Submarine Cables Trust	Cert.	6 %	6 %	6 %	..	127—130	127 —130	..	..	..
58,000	United River Plate Telephone	5	7 %	8 %	8 %	..	7 — 7½	7 — 7½	..	..	..
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	..	5½— 5¾	5½— 5¾	5¾	5½	..
179,947	Do. do. 5 % Debs.	Stock	5 %	5 %	5 %	..	110 —112	110 —112	..	..	..
15,609‡	West African Telegraph, Shares	10	2 %	4 %	4½%	..	10 — 10½	10 — 10½	..	..	..
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	Nil	Nil	Nil	..	⅜— ½	⅜— ½	..	..	..
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	..	100 —102	100 —102	..	..	..
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930	10	7 %	7 %	7 %	..	14 — 14½	14 — 14¼	14 5/16	14 1/16	..
75,000	Do. do. 5 % Debs. 2nd series, 1906	100	5 %	5 %	5 %	..	101 —103	101 —103	..	..	..
563,380	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	102½—104½	102½—104½	102⅝	..	..
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	1/16— 1/8	1/16— 1/8	1/16	..	..
34,563	Do. do. 6 % Cum. 1st Pref.	10	7 %	7 %	6 %	..	8½ — 9	8½ — 9	..	..	..
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	..	7½ — 8	7½ — 8½	8 1/8	8	+ ⅛
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800	100	5 %	5 %	5 %	..	101 —104	101 —104	..	..	..

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

40,000	British Aluminium 7 % Cum. Pref.	5	Nil	Nil	Nil	..	4⅜— 5⅛	5 — 5⅛	..	..	+ ⅛
20,000	Do. do. "A" 6 % Cum. Pref.	5	Nil	Nil	Nil	..	4⅜— 5⅛	4⅜ — 5⅛	..	..	..
20,000	Do. do. 4 % Funding Certs.	5	..	..	..	..	2⅜— 3⅛	2⅜ — 3⅛	..	..	..
300,000‡	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	..	99 —103	99 —103	102	101½	..
133,301	British Electric Traction	10	8 %	6 %	6 %	..	9 — 9⅛	9 — 9⅛	9⅛	9⅛	..
156,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	..	10½— 11	10⅝ — 11⅛	10⅝	..	+ ⅛
1,000,000‡	Do. do. 5 % Perp. Deb. Stock	Stock	5 %	5 %	5 %	..	122 —124 xd	121 —123 xd	122	..	..
250,000	Do. do. 4½ % 2nd Deb. Stock Red.	100	..	..	4½%	..	99 —101	99 —101	100⅜	100¼	..
100,000	British Insulated and Helsby Cables	5	10 %	8 %	8 %	8 %§	6⅛— 6⅜	6⅛ — 7	6⅛	6⅛	+ ⅛
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %§	5⅞— 6⅛	5⅞ — 6⅛	..	..	..
500,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	4½%§	103 —106	103 —106	..	..	..
50,000	¶Browett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	..	1/16— 1/8	1/16— 1/8	..	..	..
50,000	¶ Do. do. 6 % Cum. Pref.	£1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..
105,731	Brush Electrical Engineering, Ord., 1 to 105,731	2	Nil	Nil	Nil	..	¼— ⅜	¼— ⅜	..	..	..
150,000	Do. Non-cum. 6 % Pref.	2	6 %	6 %	6 %	..	1¼— 1⅜	1¼— 1⅜	..	..	..
125,000‡	Do. 4½ % Perp. Deb. Stock	Stock	4½%	4½%	4½%	..	91 — 94	93 — 97	..	..	+2½
125,000‡	Do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	..	78 — 81	78 — 81	80	..	..
35,000	Callender's Cable Construction shares	5	15 %	12½%	12½%	..	10½— 11½	10½— 11½	11⅛	..	..
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5⅝— 5⅞	5⅝— 5⅞	5⅝	..	..
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	..	109 —111	109 —111	110⅜	..	..
963,208	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	4 %§	91 — 93	91 — 93	92½	91½	..
523,396	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %§	101 —103	101 —103	101½	..	..
523,396	Do. do. Def. do.	Stock	4 %	4 %	4 %	..	83 — 86	83 — 86	85	84	..
1,330,000	City and South London Railway	Stock	3½%	2⅔%	2⅔%	2 %§	40 — 42	40 — 42	42	41	..
85,000	Crompton & Co., Nos. 1 to 85,000	3	5 %	2⅔%	2⅔%	..	1⅞— 1⅞	1⅞— 1⅞	..	..	..
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	..	95 —100 %	95 —100	..	..	..
99,261	Edison & Swan Utd., "A" shrs., £3 pd., 1 to 99,261	5	Nil	Nil	2½%§	..	1⅜— 1⅝	1⅜— 1⅝	1⅜	..	..
17,139	Do. "A" shares, 01—017,139	5	Nil	Nil	2½%§	..	2 — 2¼	2 — 2¼	..	..	..
344,028‡	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	83 — 88	85 — 90	..	..	+2
100,000‡	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	..	90 — 95 xd	90 — 95	..	..	..
112,100	Electric Construction 1 to 112,100	2	6 %	4 %	Nil	..	⅝— ¾	⅝— ¾	..	..	..
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	..	1⅛— 2⅜	1⅛— 2⅜	..	..	..
200,000	Do. do. 4 % Perp. 1st Mort. Deb. Sk.	Stock	4 %	4 %	4 %	..	92 — 95	92 — 95	..	..	..
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	9½ — 10	9½ — 10	..	..	..
200,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	..	96 —100	97 —101	..	..	..
200,000	Henley's (W. T.), Telegraph Works, Ord.	5	20 %	15 %	15%	10%§	12 — 13	12 — 13	12⅛	..	..
200,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	..	5⅛— 5⅜	5⅛— 5⅜	5¼	5⅛	..
45,900	Do. do. 4½ Mort. Deb. Stock	Stock	4½%	4½%	4½%	..	109 —111	109 —111	..	..	..
50,000	India-Rubber, Gutta-Percha & Telegraph Works.	10	10 %	10 %	5 %	2½%§	15½— 16½	15½— 16½	..	..	..
800,000‡	Do. do. 4% 1st Mort. Deb.	100	4 %	4 %	4 %	..	99 —102	99 —102	100	..	..
37,500	†Liverpool Overhead Railway, Ord.	10	1½%	18%	11½%	..	2 7/16— 2 9/16	2 7/16— 2½	..	..	— ⅛
10,000	† Do. do. Pref. £10 paid	10	5 %	5 %	5 %	5 %§	9 — 9½	9 — 9½	..	..	..
37,350	Telegraph Construction and Maintenance	12	20 %	20 %	15 %	..	34 — 36	34 — 36	35½	34	..
150,000‡	Do. 4 % Deb. Bds., 1 to 1,500 Red. 1909	100	4 %	4 %	4 %	..	102 —104	102 —104	..	..	..
540,000‡	Waterloo & City Railway, Ord. Stock	100	3½%	3½%	3½%	3 %§	89 — 91	90 — 92	..	..	..

* A period of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. § Interim dividends.
¶ From Manchester Share List.

Bank rate of discount 4 per cent. (September 28th, 1905).

SHARE LIST OF ELECTRICAL COMPANIES *(continued)*.—ELECTRICITY SUPPLY COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1902.	1903.	1904.	§1905.	Closing Quotations Oct. 4th.	Closing Quotations Oct. 11th.	Business done week ended Oct. 11th, 1905. Highest.	Lowest.	Rise + or Fall—
29,377	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	8 %	10 %	10 %	..	9¾ — 10¼	9⅞ — 10⅜	10⅛	..	..
29,623	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	..	9⅝ — 10⅛	9⅝ — 10¼	..	..	..
10,782	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	..	103 — 106	101 — 107	..	..	+1
80,000	Charing Cross and Strand Electricity Supply ..	5	10 %	8 %	8 %	5 %§	6⅞ — 7⅛	7⅛ — 7⅜	7⅛	7	+ ⅛
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½ %	4½ %	4½ %	..	5⅛ — 5⅜	5⅛ — 5⅜	5⅜	5⅛	+ ⅛
40,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½ %	4½ %	4½ %	..	4½ — 5	4⅝ — 5	4⅝	..	..
40,000	Do. do. 1903	5	..	4½ %	4½ %	..	4⅝ — 5⅛	4⅝ — 5⅛	..	..	..
350,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	..	103 — 105	103 — 105	104½	104⅜	..
44,436	Chelsea Electricity Supply, Ord.	5	4½ %	5½ %	6 %	4½ %§	5⅝ — 6⅛	5⅝ — 6⅛	5⅝	..	..
150,000£	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½ %	4½ %	4½ %	4½ %§	109 — 111	109 — 111	..	..	..
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	5 %	5 %	6 %	..	11 — 11¼	12 — 13	12⅛	11⅝	+ ⅜
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	..	13½ — 14½	13½ — 14½	..	..	..
400,000£	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	..	124 —128	124 —128	..	..	..
300,000	Do. 4½ % 2nd Db. Stk., Prov. Crts., all pd.	100	4½ %	4½ %	4½ %	..	104 —106	104 —106	..	..	..
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4 %	4 %	4½ %	4 %§	8⅞ — 9⅛	9 — 9⅛	9⅛	9	+ ⅛
30,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	..	12 — 12½	12 — 12½	..	..	..
400,000£	Do. do. 4½ % Deb. Stock ..	..	4½ %	4½ %	4½ %	..	111 —114	111 —114	113½	113	..
250,000	Do. do. 4½ % 2nd Deb. Stock ..	Stock	4½ %	4½ %	4½ %	..	103 —105	103 —105	..	..	..
70,000	Edmundson's Electric Corporation, Ord. Shares ..	5	7 %	7 %	7 %	..	5⅞ — 6⅛	5⅞ — 6⅛	5⅞	5⅛	..
80,000	Do. do. 6 % Cum. Pref... ..	..	6 %	6 %	6 %	..	6⅛ — 6⅜	6⅛ — 6⅜	6⅛	..	..
300,000£	Do. do. 4½ % 1st Mort Deb. Stk	100	4½ %	4½ %	4½ %	..	108 —110	108 —110	109	..	..
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	12 %	12 %	..	12 — 12⅜	12 — 12⅜	12⅛	..	..
136,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	..	97 —100	97 —100	..	..	..
111,000	London Electric Supply Corporation, Limited, Ord.	3	Nil	Nil	3 %	..	2 — 2⅛	2 — 2⅛	..	..	..
60,000	Do. do. do. 6 % Pref...	5	6 %	6 %	6 %	..	4⅞ — 5⅛	4⅞ — 5⅛	..	..	..
371,895	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	..	99 —102	99 —102	..	..	..
100,000	Metropolitan Electric Supply, 1 to 100,000	5	7½ %	8½ %	10 %	10%§	10¼ — 11	10⅛ — 10⅜	10⅜	10 7/16	— ⅛
76,121	Do. 4½ % Cum. Pref. 1—71,106, £3 pd.	5	4½ %	4½ %	4½ %	..	5⅜ — 5⅝	5⅜ — 5⅝	..	..	..
220,000£	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½ %	4½ %	4½ %	..	109 —113	109 —113	..	..	..
250,000£	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½ %	3½ %	3½ %	..	100 —102	98 —100	..	..	— 2
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½ %	4½ %	4½ %	..	100 —102⅝	101 —103	102¼	101½	+ 1
10,852	Notting Hill Electric Lighting	10	6 %	6 %	7 %	..	14 — 15	14 — 15	..	..	..
59,000	Do. do. 4 % 1st Mort. Deb... ..	100	4 %	4 %	4 %	..	98 —100 xd	98 —100 xd	..	..	..
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	14½ %	14½ %	14½ %	10%§	14 — 15	14 — 15	14¾	14½	..
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %§	8 — 9	8 — 9	..	..	..
150,000£	Do. do. 3½ % Deb. Stock Red. ..	100	3½ %	3½ %	3½ %	..	98 —100	98 —100	..	..	..
12,000	Smithfield Markets Electric Supply, Ord.	5	2½ %	4 %	4 %	..	2¼ — 2⅜	2¼ — 2⅜	..	..	..
50,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	..	76 — 80	76 — 80	..	..	..
65,000	South London Electricity Supply, Ord.	5	1½ %	3 %	4 %	..	3½ — 4	3½ — 4	..	..	..
100,000	South Met. Elec. Lt. & Power (Ord..	1	Nil	Nil	Nil	..	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..
50,000	*(Late Blackheath and Greenwich* 7 % Pref...	1	Nil	7 %	7 %	..	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..
100,000	*Dist. E.L.Co.)* (4½ % 1st Deb. Stk.	100	4½ %	4½ %	4½ %	..	105 —108 xd	105 —108 xd	..	..	..
30,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	4⅜ — 4⅞ xd	4⅜ — 4⅞ xd	..	..	..
30,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5 — 5½ xd	5 — 5½ xd	..	..	..
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red	100	..	..	4½ %	..	103 —105 xd	103 —105 xd	104½	103½	..
110,000	Westminster Electric Supply, Ord.	5	12 %	13½ %	14 %	13%§	12⅜ — 13½	12⅜ — 13⅜	13¼	13	..
28,151	Do. do. 5 % Cum. Pref. ..	5	5 %	5 %	5 %	..	6⅜ — 6⅝	6⅜ — 6⅝	..	..	..

Shares not officially quoted :—Mackay Companies, ord., 46¾—47¼. Pref. 75¾—76¼.

† Unless otherwise stated all shares are fully paid. § Interim dividends.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	£*	No. of wks.	Total to date. £	£*	Route miles open.	*
Aberdeen	Oct. 7	2,839 —	158	19	29,216	— 1,610	..	..
†Ayr	Sep. 30	333 +	7	20	8,302	— 113	8	..
Bath	Oct. 4	1,522 +	125	40	27,694	+ 1,653	13	..
Birkenhead	,, 8	2,090 —	20	27	29,193	— 534	13·5	..
Blackburn	,, 4	2,107 +	146	27½	28,098	+ 898	14·25	..
Blackpool Corp. ..	,, 5	2,437 +	47	27	41,090	+ 2,083	11·87	..
,, —Fleetw'd	,, 7	1,291 +	98	14	17,780	— 803	..	..
,, — Lytham	June 22	1,602 +	753	34	7,608	..	7½	..
Bolton	Oct. 8	3,782 +	115	28	54,922	+ 1,874	26	+ 1
Bournemouth ..	,, 4	2,876 +	680	26½	39,907	+ 6,684	13·91	+ 3⅜
Bradford	,, 7	8,744 —	691	27	123,410	— 6,484	53	..
Brighton	,, 8	1,920 —	65	28	31,216	..	9·5	..
Bristol	,, 6	9,617 —	580	..	..	..	28·5	..
Brit. Elec. Trac. Co.								
Airdrie	Sep. 29	480 +	41	39	7,992	+ 115	8·5	..
Barnsley	,, 29	315 —	35	,,	6,321	— 270	3	..
Barrow	,, 29	537 +	35	,,	9,650	+ 2,011	5·37	..
‡Birmingham (City)	,, 29	10,497 —	591	,,	211,443	+ 2,700	14·5	..
Birmingham (Mid.)	,, 29	2,854 —	451	,,	63,427	+ 1,070	12·25	..
Devonport	,, 29	961 —	111	,,	18,272	— 2,757	8·85	..
Dudley—Sto'rb'ge	,, 29	1,924 —	2	,,	35,756	+ 1,351	21·25	..
Gateshead	,, 29	1,923 —	18	,,	35,887	+ 628	11·25	..
Gravesend, N'fleet	,, 29	506 +	16	,,	9,247	— 923	6·5	..
Gr'n'k, Pt. Glsgw	,, 29	1,530 +	245	,,	25,479	+ 2,747	7·25	..
Hartlepool	,, 29	585 —	27	,,	10,544	— 1,151	6·72	..
Kidderminster ..	,, 29	271 —	9	,,	4,948	— 276	4·5	..
Leamington	,, 29	386 +	110	11	2,511	+ 1,045	..	..
Merthyr	,, 29	377 —	36	39	7,470	— 411	2·9	..
‡Metropolitan ..	,, 29	6,278	+2,301	,,	104,543	+46,621	..	..
Middleton	,, 29	704 +	43	,,	13,593	+ 579	8·5	..
Oldham — Ashton	,, 29	1,193 +	59	,,	21,824	+ 354	9·13	..
Peterborough ..	,, 29	268 —	29	,,	5,514	— 508	5·31	..
Potteries	,, 29	3,606 +	31	,,	66,069	+ 350	29	..
Rothesay	,, 29	600 +	185	,,	9,029	+ 2,582	2·75	..
Sheerness	,, 21	140 —	3	,,	2,855	+ 307	2·5	..
Southport	,, 29	646 —	47	,,	12,773	— 416	8·17	..
South Staffs. ..	,, 29	1,572 +	129	,,	28,309	+ 657	13·87	..
Swansea	,, 29	1,677 +	275	,,	27,930	+ 6,459	5·5	..
†Taunton	,, 8	57 —	3	36	1,851	— 191	1·5	..
Tynemouth	,, 29	496 —	420	39	10,734	— 1,483	3·75	..
Weston-s-Mare ..	,, 27	375 +	32	,,	6,368	+ 627	2	..
Wolverhampton D.	,, 29	888 +	49	,,	15,468	+ 107	14·75	..
‡Worcester	,, 29	653 —	1	,,	12,235	+ 601	5·75	..
Wrexham	,, 29	208 —	16	,,	4,020	— 371	4	..
Yorks. Wool. Dist.	,, 29	1,473 +	334	,,	25,626	+ 2,338	17	..
Burnley	Oct. 7	2,357 +	92	..	..	..	7·5	..
Burton-on-Trent ..	,, 8	597	..	27	9,021	..	8·5	..
Bury	,, 1	1,538	..	26	19,853	..	10·5	..
Cardiff	Sep. 30	4,128 +	21	26	56,384	+ 233	15·8	..
Carlisle	Oct. 7	377 —	21	40	7,252	— 509	..	..
Chatham and Dist.	Oct. 5	1,321 +	97	40	26,936	+ 2,991	9·3	+ ·8
Colchester	,, 4	381	..	10	2,407	..	7	..
Cork	,, 5	1,046 +	29	40	19,825	+ 708	9·69	..
†Darlington ..	Sep. 30	205 +	18	26	5,474	..	4·87	..
Darwen	Oct. 7	498 +	31	27	6,739	+ 305	4·36	..
†Dover	Aug. 12	344 +	27	32	6,651	— 268	3·5	..
Dublin	Oct. 6	9,589 —	175	..	75,792	— 575	48·5	+ 1·5
Dundee	,, 4	2,037 +	280	20	18,521	+ 584	12·5	..
East Ham	,, 7	1,622 +	259	27	23,450	+ 2,369	6·75	..
Glasgow	,, 7	32,976	+2,463	18	286,334	+14,423	76	+ 4·5
Gloucester	,, 4	775 —	2	26	8,781	..	15	..
Halifax	Sep. 27	3,339 +	295	26	43,591	+ 1,899	37	+ 4
†Huddersfield ..	,, 30	1,640 +	88	26	36,360	+ 895	28	..
Hull	Oct. 7	4,315 +	93	27	60,046	+ 603	13	..
†Ilford	Sep. 30	526 +	97	27	13,426	+ 124	..	..
Ilkeston	Oct. 5	225 —	58	27	3,346	— 725	3·5	..
Ipswich	,, 7	809 —	121	27	13,106	— 1,563	10·5	..
Isle of Thanet ..	,, 7	955 —	209	40	28,415	— 2,943	..	..
Kirkcaldy	,, 4	436 —	24	..	..	..	7·5	..
Lan'kshire Trm. Co.	,, 5	1,837 +	389	40	29,379	+ 3,396	12·5	+ 3·9
Leeds	,, 7	11,717 +	120	27	169,469	+ 3,445	89·5	+ 8
Leicester	,, 7	4,120	..	40	83,583	..	..	..
Liverpool	Sep. 30	21,281 +	73	39	414,301	+ 8,915	104	+ 1
L.C.C.	,, 23	30,475	+2,777	25	383,651	+59,738	51½	+ 4·6
†Lowestoft	Oct. 7	178 +	4	1	..	..	3·5	..
Manchester	,, 7	25,553 +	614	27	356,496	+15,167	..	..
Newcastle	,, 7	7,578 —	102	27	104,878	+ 2,999	..	..
Newport	,, 7	1,120 +	96	27	..	..	14·5	+ 1·5
Oldham	,, 8	3,275 +	878	28	46,606	+12,597	23·75	+ 5⅛
Plymouth	..	..	..	..	..	..	..	..
Pontypridd	,, 7	303	..	27	4,368	..	3·5	..
Portsmouth	,, 7	3,482 —	205	27	61,166	+ 1,498	14·5	..
Reading	,, 5	1,261 —	15	27	18,007	— 219	..	..
Rochdale	,, 7	1,616	+1,051	25	21,284	+16,287	21·2	+ 8·1
Salford	,, 2	8,667 +	186	27	117,643	+ 6,600	..	..
†Scarborough ..	Sep. 30	327	..	39	7,295	..	4·5	..
Sheffield	Oct. 8	9,931 +	618	28	139,729	+ 6,461	35·75	- 1·5
†Southampton ..	Sep. 27	1,974 —	47	26	26,699	— 559	..	..
Southend-on-Sea ..	July 26	1,089 +	67	17	6,596	+ 468	6·25	..
†Stalyb'dge, Hyde, &c.	Sep. 30	1,306 +	355	26	17,470	..	21	..
Stockport	Oct. 6	1,622 +	517	27	20,896	+ 4,175	15·5	+ 4
Sunderland	,, 8	2 460 +	43	27	37,600	+ 981	..	..
†Swindon	Sep. 27	199	..	26	5,384	..	4·4	..
Tyneside	Oct. 4	785 —	144	40	16,837	+ 995	8·87	..
†Warrington	Sep. 14	345 +	18	24	8,291	+ 400	6·37	+ ·25
West Ham	Oct. 5	4,125	+1,922	27	48,271	+20,101	13 25	+ 3·4
Wolverhampton ..	,, 4	1,626	..	27	22,378	..	10	..
Cen. London Rly.	Oct. 7	13,139 —	85	14	81,911	— 1,859	6	..
City & S. Lon. Rly.	,, 8	5,268 —	15	14	33,126	— 573	6·25	..
Dublin-Lucan Rly.	,, 6	247 +	2	14	2,044	+ 31	7	..
G. N. and City Rly.	,, 7	3,145 +	650	14	20,413	+ 5,318	3·5	..
L'pool Overh'd Rly.	,, 8	2,827 —	215	..	23,762	— 854	6·75	..
Mersey Railway ..	,, 7	3,165 +	129	14	21,750	+ 1,367	4·5	..

* Compared with the corresponding period of 1904. † One week only. ‡ Includes horse and other receipts.

BELT COAL CONVEYORS.

By FRANCIS H. DAVIES.

In the design of power stations not favoured with facilities that render such apparatus unnecessary, the question of coal-conveying gear is always one of some moment; but when considered in connection with the mammoth power undertakings that are now springing up in all parts, this section of the auxiliary gear assumes an importance that gives it a position among the leading features.

The available ways and means of carrying coal from place to place are indeed legion, and in many instances the ingenuity that has been brought to bear on the details of such apparatus is remarkable and interesting to follow; in this article, however, it is proposed to deal only with that

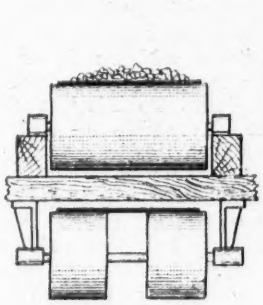


Fig. 1.

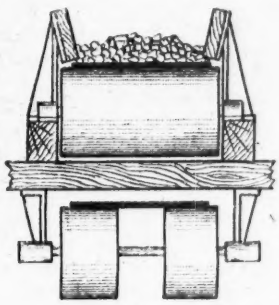


Fig. 2.

class of machine known as the belt conveyor, for the reason that in Great Britain, at any rate, it is less understood and therefore, perhaps less trusted than the familiar "bucket," "worm," and "push-plate" types.

Unlike the above, it is difficult to fix any date for the inception of the belt conveyor; it would appear that as long as belting has been known and used, it has been adapted in a more or less crude manner to this purpose; consequently, dates of patent applications, the usual source, serve only to mark epochs in the history of the subject, and cannot necessarily give any idea of when it entered the realm of things that be. Belt conveying has unquestionably been evolved, and in view of its recent adoption on a large scale in sundry power houses, both in Great Britain and America, and the improvements that are now enhancing its value to the engineering world, it may not be out of place to consider one or two of the old designs which were so notoriously bad as to have left their mark on the credit of the system, even to the present day. Broadly speaking, the disadvantage under which belt conveying suffers is high cost of upkeep due to the wear and tear of the belt itself, not to that of its pulleys or gearing in any way. On the other hand, broadly, its advantages are low first cost, greater reliability, having fewer parts to break down than any other apparatus, and the extremely small amount of power that it absorbs in operation. These two last features, particularly the latter, are of such obvious importance, and so pronounced, that they are generally accepted as a set off against the disadvantage of costly upkeep; and there are not wanting enthusiasts who go so far as to say that with well-designed and carefully-tended plant the high repair bogey is nowadays an utter myth. Many, no doubt, may hold opposite opinions, but it is significant at least that two of the largest electrical power stations in the world, viz., that of the Underground Electric Railways of London at Chelsea, and the immense installation of the Interborough Rapid Transit Co., New York, have quite recently been fitted with belt coal conveying gear on a large scale, and it is unlikely in either case that such a course would have been taken except upon the very soundest of grounds.

As is only natural, the earliest form of belt conveyor differed in no degree from an ordinary driving belt. It consisted of an endless belt of cotton duck generally faced with a thin sheet of india-rubber, running over flat pulleys as shown in fig. 1, the return or underneath side of the belt being supported at intervals by suitable idle pulleys. Needless to say, this primitive arrangement was soon found to be unsatisfactory; it was only capable of carrying a disproportionately small amount of material, owing to the tendency of the latter to fall off the belt; it had to be kept very tight to prevent jarring at the pulleys and consequent shaking off of the load; and, chiefly owing to this latter reason, the loss of power in the bearings was considerable. Further, it was only capable of slow speeds, and the amount of material delivered to the belt had to be most carefully and evenly regulated at all times. This system was found most suitable for conveying light stuff such as grain, as the resistance to motion created by the air tends to keep the load in a central position, with the result that with care speeds of 300 to 400 ft. per minute may be attained. On the other hand, heavy material such as coal is not in any way affected by the air resistance, and consequently tends to spread itself out, necessitating much lower speeds and more care in working.

Perhaps the most obvious remedy for these faults lies in the arrangement shown in fig. 2, in which it will be noted that planks of wood have been fixed on brackets at each side of the belt, with the object of keeping the material from falling over the edges. As far as this is concerned the skirting board system is satisfactory, but it introduces a very considerable fault that militates against the improvement which it effects.

It is found that the spaces between the underneath edges of the planks and the belt become full of the material that is being conveyed, and as to a certain extent this latter is wedged in and jammed, the result is bad cutting of the belt at the edges, which soon reduces it considerably in width.

This brings us to the stage of development which is the precursor of all modern systems, although, *per se*, still full of faults. The double conical pulleys over which the belt runs (fig. 3) force the sides of the latter up, forming a continuous trough; but as there is a wide difference between the peripheral speeds of the inner and outer edges of the cones, a large amount of slip occurs between them and the belt, which slip deteriorates the under surface almost as badly as the former system. The only feasible method of troughing a belt—and such is found to be absolutely necessary for conveying purposes—is to employ separate and distinct idle pulleys at the sides, as shown in fig. 4, which is an end view of the well-known Robins system of belt conveying. By this arrangement there is no slip, and the wear and tear of all parts is reduced to a minimum. Occasionally the belt evinces a tendency to lift, in which case the spindles of the two side idlers are fitted with small rollers, placed at right angles so as to bear on the edges of the belt and keep it in position (fig. 5). A further refinement shown in this

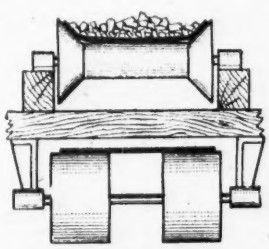


Fig. 3.

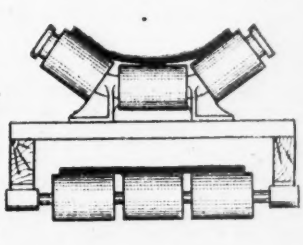


Fig. 4.

figure, and used at the place where the load is fed on, is that of skirting boards placed well clear of the edges of the belt, but so arranged as to protect them from the falling coal, which is thus caused to impinge on the heap in the centre of the belt.

This is the type of conveyor installed at the power house of the Interborough Rapid Transit Co. of New York for elevating and carrying coal to the bunkers. In this particular case all the conveyors are of from 300 to 500 tons per hour capacity and use a belt 30 in. wide. A very similar arrangement made by Mead, Morrison & Co., New York, is used at the Lot's Road power station of the Underground Electric Railways Co. of London. The belt conveying coal to the crushers is 30 in. wide with a length of travel of 190 ft., and although its full working capacity is 240 tons per hour, a 10-H.P. motor is ample to operate it. Two other similar conveyors are installed at Lot's Road for

carrying the coal after crushing, &c., to the bunkers. Like the former they are horizontal, but only 24 in. wide, and as their length of travel is nearly 500 ft., they require more power, each being driven by a 20-H.P. motor.

A recently introduced and ingenious method of belt conveying, is that known as the Ridgeway two-belt system illustrated in figs. 6 and 7. Referring to these, it will be seen that running on separate and smaller pulleys there is an internal flat belt, fitted equidistantly with white wood blocks of an internally curved shape, which are riveted to it.

The driving pulley of this carrying belt is rotated through he agency of a compensating gear from the main power

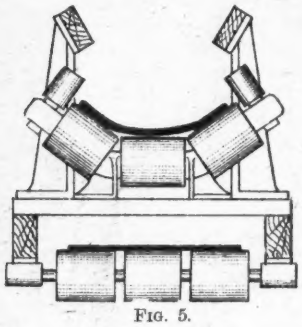


Fig. 5.

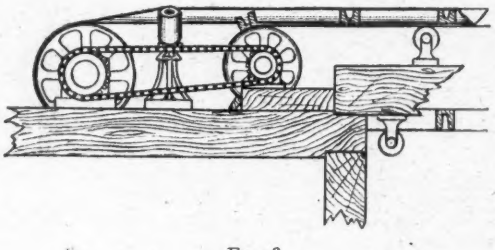


Fig. 6.

shaft of the conveyor, and the belt is provided on the top side with its own idle pulleys where necessary. The upper or conveying belt runs on flat pulleys at the driving and the driven ends, but at the points where it enters and leaves the blocks of the carrying belt, centring rolls are provided as shown, the duty of which is in the first case to give the upper belt the required curve before entering the blocks, and in the latter, to prevent its springing out of them as it approaches the end of its travel, and tends to go flat. On the return path, both carrying and conveying belts run on the same idle pulleys as shown, the blocks of the former bearing on the inside of the latter. The two belts run at exactly equal speed, although quite separate, and it is claimed that there is no rub between them, and that, with the exception of the power required to rotate the bottom idlers, the carrying belt does all the work, thus minimising the wear and tear of the conveyor.

Reverting to the Robins type of conveyor, which may be taken as representative of usual practice, the width of the belt and the weight of the load determine the distance apart of the idler pulleys; but, generally, those whose function it is to trough the belt are placed from 3 to 6 ft. apart, while the lower or return set may be anything from 8 to 12 ft. Where circumstances are favourable, it has sometimes been possible to run the belt to a very great degree on simple flat pulleys, placing one of the centring type, say, at every fourth position to shift the material, which naturally spreads out when the belt is on the flat-back, to the centre. The excuse for adopting such a method is, of course, cheapness; but it is doubtful if it is advisable excepting for the very lightest class of load conveyed at high speeds.

Of all the auxiliary gear attached to belt coal conveyors, perhaps that which provides for the loading of the belt is the most important. The chief cause of wear lies in the impact of the coal, and it follows, therefore, that this must be reduced to the lowest possible amount by feeding through a properly-shaped inclined shoot in the same direction as the travel of the belt, and as near as possible at the same speed. Vertical feeding is very harmful, and should never be resorted to.

Another important auxiliary detail is the tripper, which may be fixed or movable, automatic or otherwise, as occasion requires, and is used for unloading the belt at other places than at the end of its travel. It is shown diagrammatically in fig. 8, and as will be seen, consists essentially of two pulleys, placed almost vertically, through which the belt takes an S-shaped path, the load leaving it at its first bend, and falling into a shoot arranged to deliver at the side. This tripper may be fixed in one position, or it may be movable, either by hand, or through gearing by the belt itself, in order to distribute the coal uniformly in the bunkers. Also, by the agency of two parallel shoots it may be made automatic, the coal, after filling one bunker and therefore the shoot, passing down the second one back to the portion of the belt that has been through the pulleys.

The use of belt conveyors on an incline, such as that shown in the above diagram, is quite practicable under suitable conditions. A continuous supply of load is necessary if the incline approaches an angle of 30°, but with smaller angles a material such as coal will not slip appreciably even when fed intermittently. As previously stated, the wear of the belt has been the chief deterrent to the wide spread use of these conveyors. It did not require much experience with them to show that while a rubber facing of the right kind withstood the wear very well, the canvas duck which forms the principal part of the belt deteriorates very rapidly where exposed to the cutting action of the load. For this reason conveyor belts are now made with a specially prepared rubber face of considerable thickness in the centre where most of the wear takes place. To allow it to assume a troughed shape easily, it is usual to decrease the thickness of the canvas backing in the middle, compensating for this by additional rubber. The thickness of the latter must depend upon the nature of the material the belt is destined to carry. Grain and such light stuff require only a thin layer, but coal being comparatively heavy and having many cutting edges calls for a thickness in the centre of approximately a quarter of an inch of rubber, which may be thinned down to an eighth or a sixteenth of an inch at the edges where the wear is less.

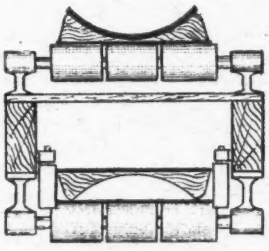


Fig. 7.

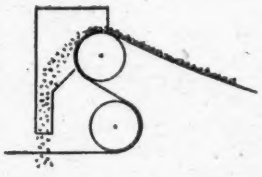


Fig. 8.

As regards speeds and widths: the former may vary very largely according to conditions and individual ideas on the subject, and may be anything from 100 to 900 ft. per minute, although this second figure is by no means usual or to be recommended, as it puts very hard work on both the pulleys and the belt. 400 ft. per minute is a fair speed for level work, and for elevating this may be increased with advantage.

Widths range generally from 12 in. up to 36 in., and a troughed belt of the latter size will carry nine times as much as one of the former, the capacity varying as the square of the width.

NOTES ON THE SELECTION OF INCANDESCENT LAMPS.

By J. E. DAWSON.

Considering the desirability, from the electric supply undertaking point of view, in these days of strenuous and increasingly keen competition with gas, that its customers should install and use only the most suitable and efficient types of incandescent lamps on the market, taking into account all the various factors—*local* and general—it is somewhat surprising to note the small amount of attention which has hitherto been given to this subject by central station engineers.

Fortunately, however, for the reputation of electric lighting, there are signs that this apathy is now being, to some extent,

shaken off and schemes are being adopted in various parts of the country, notably Coventry and Norwich, for the maintenance and renewal of consumers' lamps, and there can be very little doubt that these and similar schemes will, directly or indirectly, be the means of placing the future selection of incandescent lamps on a much more scientific and precise basis than has been the case in the past.

It may be remarked that the judicious selection of incandescent lamps involves problems—unhappily for the consumer—of a very different and much more difficult character than the selection of most other articles of every-day commerce, and out of the multiplicity of makes of lamps of all prices and efficiencies which are sold at the present day, it is absolutely impossible to single out one particular make as being the most suitable for use under any and all circumstances and conditions. Yet, notwithstanding this undoubted impossibility, it appears to be the usual practice for the great majority of lamp manufacturers and selling agents to invariably claim (without any qualifying clauses whatever) that their particular lamp is the best, cheapest, and in every way most economical lamp on the market; and in many instances they back up their claims by giving figures (the most relevant, however, usually omitted), which purport to prove that their statements have, in practice, either been substantiated or more than substantiated.

These extravagant claims are, of course, taken at their true value *cum grano salis* (tell it not in Gath) by those who are conversant with the technicalities of the question; but what about the average consumer who is, as a rule, totally ignorant of these matters and without any means of testing or checking in any way the many conflicting statements? How is he to choose between one lamp and another except by the bitter experience method, ending probably with dissatisfaction at electric lighting generally?

It may, perhaps, be permissible to point out that the real root of the problem of the most suitable lamp to use consists not simply in the ascertaining of the most efficient or the cheapest lamp on the market *per se*, but in the obtaining of *candle-power-hours at the lowest total costs*, and one of the most important determining factors in deciding this, one which is only too often completely overlooked, is the cost of electrical energy with which the lamp or lamps are to be supplied. In cases where electrical energy is cheap, the efficiency of the lamp is not such an important factor as the "life" and "cost of lamp renewals," and conversely in cases where electrical energy is dear, the efficiency of the lamp is the most important item, and that of "life" and "cost of lamp renewals" are only of secondary importance.

The relative values of the various items composing the total cost per C.P.-hour are set forth in the following formula:—

$$\text{Total cost per C.P.-hour} = \frac{\text{cost of lamp in pence}}{\text{life in hours} \times \text{average C.P.}} + \text{average watts per C.P.} \times \text{cost in pence of 1 watt-hour of electrical energy.}$$

The particular lamp which enables the lowest result to be obtained in the above formula is from the consumers' point of view the best—the most economical—lamp to use, quite independent of any difference between it and other makes of lamp, either as regards cost or efficiency. The serious difficulty, however, in the practical application of this formula is that several of the factors which have an important bearing on the result, can only be reliably ascertained by means of a series of extended tests under actual working conditions, requiring, in addition to a supply of current, technical instruments and more or less of a technical training to manipulate them. This difficulty, which is, of course, unfortunately inherent to the problem under solution, is the crux of the whole question, and is, indeed, essentially the primary reason why the great majority of consumers have, hitherto, had no option but to choose their lamps on blind, haphazard, rule-of-thumb methods, the evil effects of which, needless to say, are daily becoming more and more manifest.

There seem to be for supply undertakings but two alternative methods of dealing with this difficulty, either that it should be boldly tackled or that it should be calmly ignored; the latter is, of course, the easier, and up to the present the one generally adopted in this country, but owing to the vast improvements which have been recently effected in gas accessories, thus enabling that old-time rival now to become a most formidable competitor, it is not so certain that the methods which have sufficed in the past will, *ipso facto*, suffice in the future.

There can be no gainsaying the fact, by any one with any practical knowledge of the subject, that the policy of "let well alone" of the past has been proved to be a failure, and has resulted in large quantities of inefficient and unsatisfactory lamps being foisted, under various pretences, on electric lighting consumers, to the detriment of electric lighting generally. It might also be incidentally remarked that it does not by any means follow that these inefficient and unsatisfactory lamps are necessarily bought by the consumer at a low price; if such were the case comment would be needless, as the transaction would point its own moral, but instances are continually occurring where consumers who have paid a really good price for their lamps have yet, owing to not being aware of the many pitfalls to be avoided, found themselves in one way or another imposed upon.

Probably the most effective method of safe-guarding the consumer, and at the same time securing the best all-round results, would be for the various supply undertakings to assume control of the maintenance and free renewal of consumers' lamps; but in the writer's opinion it is exceedingly doubtful whether the time is yet quite ripe for such a drastic step, as, apart from the economics of the question (and it is extremely probable that it would involve the undertaking in considerable expense), it is open to the strong objection, held by a great many people, that it is trespassing too far upon the legitimate sphere of the local wiring contractors, and would also most certainly raise a considerable amount of opposition and friction with this body generally; and although it may perhaps be contended by some that the latter point ought not to be allowed to interfere with the working of any project that is deemed just and necessary, yet, at the same time, it must be admitted that it is very desirable, wherever reasonably possible, that the two branches of the supply industry should work amicably together and in co-operation with each other, as it is only in such a manner that the two can deal most effectively with what is, after all, the common object of each—the extended use of electric lighting.

The writer, however, is of the decided opinion, bearing in mind what has been previously mentioned herein regarding the complex and difficult nature of the problems which have hitherto confronted the consumer in the selection of the—to him—best lamp to use, and which it is quite apparent have been, and, indeed, must always be by virtue of their technical nature, beyond the capacity of the ordinary consumer to decide, that it would be much more appropriate and fitting that the supply undertaking should, first of all, attempt to remove or, at any rate, minimise this stumbling block before embarking on anything of a more extreme character. Moreover, the cost of this would be comparatively small to any but the smallest of undertakings, and, as it could surely not be deemed to be encroaching on the just rights of others, the writer ventures to think it is quite the most suitable and urgent direction in which the supply undertakings should first attempt improvement.

Should there be schemes formulated, in the near future, by supply undertakings, with this object in view, the following suggestions may possibly contain some point which might be usefully incorporated, as there is every probability that it will be on somewhat similar lines that such schemes will, in practice, be most advantageously worked:—

(*a*) The supply undertakers to institute, as part and parcel of the working of the station, the careful and systematic testing of the various makes of lamp on the market for "candle-power," "current" and "life."

(*b*) The lamps to be tested in batches of say half-a-dozen of each make at a time, and purchased, if possible, locally, so as not to obtain lamps specially picked out for the purposes of the test.

(*c*) To keep in touch with lamp manufacturers and selling agents as to the net price at which they are prepared to sell lamps to consumers, in varying quantities, in the town under note, either direct, or through the local wiring contractors.

(*d*) Working out all results in accordance with the formula previously mentioned herein, or any similar formula, which duly takes into account the various factors concerned.

(*e*) Tabulating all results so that they may be available for ready reference.

(*f*) Half-yearly or yearly summing up the results of the tests,

and picking out the 4, 5 or 6 makes of lamps, which have given the best all-round results.

(*g*) When the accounts for energy are sent out, a note or printed slip to be added in a prominent position, informing the consumer that, as the local supply undertakers are, at all times, anxious to promote, as far as possible, the efficiency of electric lighting, and as it has been brought to their notice that a considerable amount of harm has been done owing to the use of unsuitable lamps by consumers, due to their lack of guidance on this matter, the supply undertakers have carried out a series of careful tests upon the various makes of lamps on the market, when used under ordinary working conditions, and with the current as supplied locally, and that the results had been, taking into consideration "candle-power," "consumption of power," "price of energy," "life," and "cost of lamp," that the following 4, 5 or 6 (as the case may be) makes of lamps have been found to be decidedly the cheapest and most suitable to use locally.

The note should also add the fair market prices at which such lamps can be obtained in varying quantities in the town under note.

It will be at once apparent that there is one outstanding difficulty which the above suggestions make no attempt to cope with, namely, that due to consumers continuing to use their lamps long after they have become blackened and extremely inefficient. To the writer, however, it appears that, as this is entirely an ordinary simple commercial question, variations of which, in one form or another, the consumer is probably dealing with scores of times every day, it would be the most feasible plan to attempt to educate the consumer, either by means of pamphlets and notices, or by a little personal advice now and again, to appreciate the point for himself. Furthermore, it is most difficult to see how the supply undertakers could themselves deal with this question satisfactorily on their own responsibility, except at considerable expense, probably by the "free renewal of lamps," and, as before mentioned, this hardly seems practicable at present.

REVIEWS.

Magnetism and Electricity for Students. By H. E. Hadley, B.Sc. London: Macmillan & Co. 1905. Price 6s.

Considered as a text-book for candidates preparing for the B.Sc. examination of the University of London or for Stages II. and III. of the Board of Education examination, this book is satisfactory. The student who has learned the "summary" the author gives at the end of each chapter, and has worked through all the examples, will be in a position to face his examination papers with equanimity. From the point of view of most students, this is the primary consideration, and so they will welcome this book. From the educational point of view it is also satisfactory, as it provides an extensive and fairly safe foundation on which the student of electrical engineering may build his technical knowledge. The author has studied to good purpose many of the recent papers and books on the developments of electrical theory and practice, and so he has noted the shift in the centre of gravity of the kind of electrical knowledge useful for students. He is also not a worshipper of squared paper and sloppy mathematics.

We have noticed one or two places where the student will probably receive wrong impressions. For instance, it is stated that if it can be proved experimentally that the forces in Gauss's A and B positions are in the ratio of 2 to 1, then the law of inverse squares is verified (p. 34). It is conceivable, however, that there may be some other law according to which the ratio of the forces in the two positions would be as 2 to 1. Some students might be led to think that "If X is Y, Z is W, but Z is W, therefore X is Y," is sound reasoning. Again, the statement of the "skin effect" on p. 548 is unsatisfactory. Rapidly alternating currents distribute themselves in such a way that the magnetic forces they produce in the solid metal are a minimum. In a concentric main, for example, they would be confined to the outside of the inner conductor and the inside of the outer conductor. In general, the particular position of the surface they occupy depends on the position of the return conductor. In two parallel wires they will be distributed unevenly over the portions of the surfaces of the wires facing one another. The formula given by physicists only applies to the inner conductor of a concentric main.

The treatment of electrostatic capacity is carefully done but there is considerable confusion between the capacity of a conductor (Maxwell's definition), and the capacity of a condenser. The student will need for examination purposes the definition of the capacity *between* two conductors, given, for instance, in the latest edition of J. J. Thomson's *Electricity and Magnetism*. The author refers the student to this work for a proof of the formula of the quadrant electrometer. The proof, however, given by J. J. Thomson is not meant to be taken as a rigorous proof.

On p. 229 it is stated that a lightning discharge "*probably* chooses the path of least resistance." It would be more correct to say that it goes by the path of least resistance, but that our present knowledge does not enable us to fix that path with certainty.

In discussing "magnetic viscosity," the author says: "This effect is so marked that it cannot be observed by the ballistic method." We do not understand this. As a matter of fact, on the very few occasions when viscosity is present in the iron being tested, it is most easily detected by the galvanometer method. Too much stress is laid on the loops of "electric strain" (p. 551) first discussed by Hertz. These correspond to the "singular solution" of Maxwell's differential equations for the propagation of electromagnetic waves. We think that the main laws of wireless telegraphy can be proved without considering these solutions at all.

The definition of mutual inductance given on p. 419 is really an assertion. It is not properly explained why it is called *mutual* inductance. The thinking student who is not prepared to swallow everything, would probably have great difficulty in believing it. On page 428 it is proved that the wave of E.M.F. generated in an earth inductor when rotated with uniform angular velocity is sine shaped. "*In the absence of self-induction*, the current would vary in the same manner." The student would deduce from this the erroneous conclusion that when there is self-inductance the current wave is not sine shaped.

In several parts of the book the author displays considerable originality, the diagrams are good, and the proof sheets have been very carefully read. The book deserves to be successful. A. R.

Electrical Practice in Collieries. By Daniel Burns. Second Edition. London: Charles Griffin & Co. 1905. Price 7s. 6d. net.

This work is really a text-book adapted for the use of mining students rather than a really serious attempt to provide a work on colliery electrical engineering. To colliery officials and others who have little or no knowledge of electricity it will no doubt prove useful, and may serve as an introduction to more technical works dealing with the science of electrical engineering, to which, in fact, the reader is referred by the author.

The book contains some nine chapters, the first four covering the electrical portion, whilst the remainder are devoted to lighting, pumping, haulage, coal-cutting, and miscellaneous matters, which latter include shot-firing, rock and coal drills, winding, signalling, ventilation, &c., and at the end of each chapter is a series of questions forming exercises for the student. Much of the matter is scarcely in accordance with what is now considered the best practice in colliery work, and considering the importance of three-phase machinery for mining work, this hardly receives the attention it deserves. In dealing with "faults" which may occur in machines, the author says, when speaking of the commutator, "The commutator may receive an accidental *knock*, and as a result may have one or more of its segments driven below the level of the others. Should the commutator be much damaged, the better plan is to rebuild it," but "if only one or two sections are thus lowered, they can in some cases be brought back by gripping the lugs with a small vice and then using a lever to pull them back into position." Provided a commutator *did* receive such a knock and became so damaged, it would be interesting to see it after it had been operated on by the colliery mechanic with his small vice and lever.

The illustrations, with the exception of a few diagrams, are, for the most part, from half-tone blocks, which are of little use to the student, as they merely show the appearance of the

machines, and give no idea of their actual construction, and—if we may be allowed to make a suggestion—the addition of a few sectional drawings showing the construction of dynamos and motors would not only increase its usefulness, but better hold the attention of the student. The mechanical and mining part of the work is good, and the numerous examples showing the use of the formulæ for finding the necessary power in pumping, haulage, lighting, &c., will prove useful to the student and others uninitiated. The new special rules under the Coal Mines Regulation Act are added at the end of the volume.

Principles of Electrical Power. By A. H. Bate. London : E. and F. N. Spon. 1905. Price 4s. 6d. net.

On taking up a book bearing the above title, one wonders whatever any author can find to say on the subject that has not been already said over and over again by other writers. It is agreeable, therefore, in turning over the pages to find that the author is, in this case, writing about that with which he is practically acquainted, and that the book is not merely a re-hash of others which have preceded it.

The book is one of the series of Finsbury Technical Manuals, of which Prof. S. P. Thompson is the editor, and is apparently intended rather as a hand-book for mechanical engineers, whose work necessitates a general acquaintance with the principles underlying the working of electric motors and their accessories, than for the electrical engineering student.

The author explains simply and clearly the fundamental principles of electro-magnetism and their application in the construction of electric motors.

The various parts of motors, starting and regulating switches are described, and the economy of different methods of speed control is discussed.

The care of dynamos and motors, and the principal requirements of fire insurance offices are touched upon, as are also costs of driving and systems of charging. Some serviceable data as to the costs of energy in actual installations are given, and at the end of the book is a list of powers required by various machines. This list is compiled from figures published from time to time in the technical Press and elsewhere, but the powers given, whilst serving as a guide, must not be taken as absolutely accurate, as much depends upon the make of machine and other conditions. To take only the powers stated for printing machines : powers are given for various sizes of letterpress and litho machines, but no mention is made of the number of impressions per hour, a most important consideration.

Again, two machines printing the same sized forme and turning out the same number of copies, will take different powers if of different makes. A rotary press, according to the list, takes 15 H.P. when printing 2,000 sheets an hour, but no size is given. A rotary may turn out more than 2,000 copies an hour, and only absorb about 5 H.P. This is one of the risks an author takes in copying data of machines with which he is not familiar. Had he acknowledged the sources of his information, he would not have assumed responsibility for the accuracy of the figures, and he would at the same time have complied with a recognised rule in the unwritten code of literary etiquette.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

(*Continued from page* 564.)

New Measuring Instruments.

Messrs. Kelvin & James White, Ltd., are at present placing on the market a cheaper type of moving-coil instrument than their standard or "A" type. The instrument (fig. 57) is fitted in an enamelled iron case of slightly different pattern and finish from their "A" type, but as regards movement, &c., is almost similar. In the ammeters of this class they are arranging for the shunts up to 50 amperes to be fitted inside the instruments, thus obviating the use of shunt leads up to this range. The instrument is well made and dead beat. We understand, however, that by means of improved methods of manufacture and alteration in detail that do not affect principle or accuracy, the makers are able to sell this instrument at a considerably less figure than their standard make. This will be appreciated by engineers for use on small installations, where they do not require such a high class instrument as the firm's pattern "A."

We illustrate in fig. 58 Lord Kelvin's portable wattmeter, which is intended for general testing work in the laboratory, the test-room, or the workshop, and is suitable for use on either continuous or alternating current circuits. It is of the electro-dynamometer type, the coils being arranged astatically, thus annulling any effect due to external fields. This arrangement is particularly useful when testing with continuous current, since it is not necessary to take reversed readings, the effect of the horizontal component of the earth's field being annulled. The case of the instrument is

Fig. 57.—Kelvin & White Moving-Coil Instrument.

made of a non-conducting material, which still further increases the accuracy, in that there is no error due to eddy-currents. The four main or fixed coils consist of a number of turns of wire or ribbon, and are arranged in pairs placed vertically one above the other on parallel axes. The two moving coils are connected in series, each moving within one of the pairs of fixed coils. The moving coils are suspended by a phosphor bronze strip which is attached at its upper end to a worm head, thus providing an easy and rapid method of setting the zero. A pointer is attached to the moving coils and moves over a scale about 6 in. in length. A mirror is

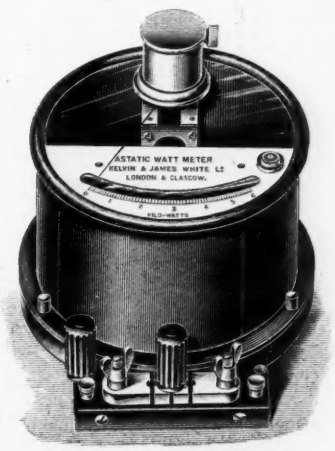


Fig. 58.—The Kelvin Portable Wattmeter.

fixed close to, and in the same plane as, the scale, and the pointer is placed on edge. This arrangement enables very accurate readings to be obtained, in addition to eliminating any possible error due to parallax.

The instrument is absolutely unaffected by wave-form, and the self-induction of the moving coils is reduced to a minimum.

A large non-inductive resistance is fitted in series with the moving coils, reducing the current through them to a very small amount. This resistance is sub-divided in order to reduce the capacity of the shunt circuit, as well as to prevent coils at widely different potentials being brought together. When used on voltages of less than 500 volts the resistance is fitted inside the instrument, but for higher voltages the resistance is fitted in a box separate from the instrument. Suitable damping arrangements are provided to give any degree of dead-beatness. The main coils can be arranged to give either one or two ampere-ranges. The latter are obtained by bringing the leads to contact blocks, so that by means of plugs the coils can be connected in series or in parallel.

E.C.C. Starters, Switches and Fuses.

In fig. 59 we illustrate the latest E.C.C. pattern of alternating current auto-transformer motor starters for polyphase circuits. It has a cast-iron frame suitable for mounting on the wall. The framing carries a slate panel, on which is mounted a double-throw starting switch for connecting the motor to the starting position, to the running position, and to the "off" position; also two or three fuses of switch type, according to whether the service is two or three-phase. Two transformers are contained in the iron case, and these are provided with several tappings, which can be easily changed to suit the starting conditions of the motor.

Fig. 60 illustrates one type of the E.C.C. patent long range switch, which is used for switching circuits off and on at a distance. The particular switches illustrated were supplied for incandescent street lighting circuits, and were fixed in the bases of the lamp columns. The design of these switches is such that the current through the solenoid is only "on" for the instant required to operate the switch. The same solenoid is used for making the switch, and also for breaking. When one end of the solenoid circuit can be connected to the local distributing circuits, only one small pilot wire between the switch and the control station is necessary, and several long range switches can be operated by one pilot wire if connected in series.

We illustrate in fig. 61 the E.C.C. double-pole quick-break main switch; we show the enclosed type, but with the cover removed. The switches are mounted on slate bases, a separate slate being provided for each pole. The bases are carried on a cast-iron frame and insulated therefrom, and a sheet of Uralite is provided to form a shield between the poles. The cover is of cast-iron, the handle operating through a slot.

Yet another of the specialities of the Electric Construction Co., Ltd., of Wolverhampton, appears in figs. 62 and 63, showing a new type of switch fuse suitable for circuits up to 500 volts. This has recently been put on the market. The fuse carrier has a substantial porcelain handle, with contact caps babitted to same. The fuse strip is attached to this by set screws having large surface per contact, and is enclosed in a ventilated fireproof tube. A feature of these fuses is the slotted hinge, which acts as a guide and enables the carrier to be plugged in or withdrawn with facility equal to that of the operation of a knife switch, and without any risk of straining the contacts. A flange on the handle affords protection to the operator, and the fireproof tube prevents any arc from spreading or damaging adjacent apparatus. No portion of the fuse strip is carried through the porcelain handle. All fuses are interchangeable, and new tubes can be replaced in a few seconds at small cost. These fuses are recommended for power distribution boards.

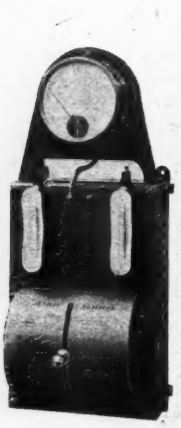


Fig. 59.—Auto-Transformer Motor Starter.

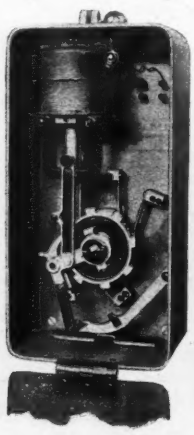


Fig. 60.—Long Range Switch.

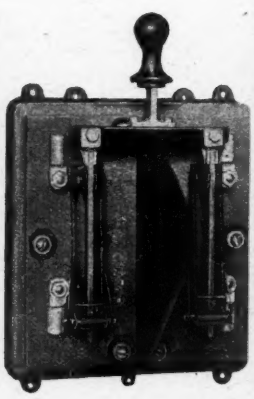


Fig. 61.—Main Switch.

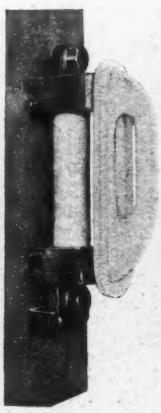


Fig. 62.

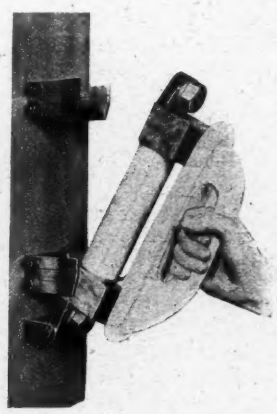


Fig. 63.

New Switch Fuse.

Cooper-Hewitt Mercury Vapour Lamp.

Many engineers will remember the demonstration of the Cooper-Hewitt lamp which took place about two years ago at the offices of the British Westinghouse Electric and Manufacturing Co., Ltd. These lamps, which at that time were more or less in their experimental stage, have now been placed on the market by the above firm, and are supplied in two sizes. The large size is 45 in. in length, and takes 3½ amperes at 110 volts; the candle-power is about 800. The smaller lamps, which are about 20 in. long, are usually run two in series on a 110-volt circuit; they take the same amount of current as one large lamp. At present they are made for direct current circuits only, but experiments are being carried out with a lamp suitable for an alternating supply. The mercury vapour light is highly efficient; in fact, the Cooper-Hewitt lamp has twice the efficiency of an ordinary arc lamp, and from six to seven times the efficiency of the incandescent electric lamp. The light is deficient in red rays, which makes it very restful for the eyes, and it is consequently specially useful for drawing offices and machine shops, where delicate work is carried out. The life of the lamp is,

Fig. 64.—Cooper-Hewitt Mercury Vapour Lamp.

on an average, about 2,000 to 3,000 hours, after which period the tubes can be replaced by new ones at a low cost.

Enclosed Switch.

The Electrical Trades Supply, Ltd., of Britannia Works, Great Charles Street, Birmingham, have just put on the market the new gas and water-tight enclosed switch which we illustrate in fig. 65. This is of especially strong construction, and has been designed for use in coal mines, factories or works where explosive gases are likely to be. Unlike ordinary cast-iron boxes used for this purpose, the handle and the lid are inter-locked by means of a bolt (seen on the left of the illustration), so arranged that in the event

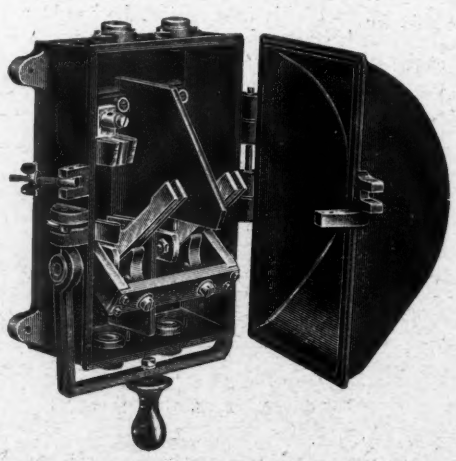


Fig. 65.—Gas and Water-tight Enclosed Switch.

of the switch being in its "on" position, the lid must not only be closed, but it must be clamped down tight, and on the contrary, if the lid is open even to the smallest extent, the switch must be in its "off" position, and is so arranged that it is quite impossible to complete the circuit even by pressing the switch blades down by hand.

The switches are massive in construction and have a wide break. The boxes are arranged (1) with screw holes for conduits; (2) with bushed holes for the cables to pass through; (3) with gas and watertight glands, having insulating bushes through which the cables pass, thus obviating all danger of the glands cutting through the insulation of the cables. Provisional protection has been secured by the inventors. An illustrated price list of these switches is being issued.

Wireless Cluster Fittings.

Messrs. Generators, Ltd., of Manchester, are introducing these fittings (Benjamin's patents), which we illustrate below. The clusters consist primarily of an insulating base of porcelain, to which are attached two contact plates, each provided with a binding screw, and serving like terminals of all lamps in the cluster. The

Fig. 66.—Wireless Cluster Ceiling Fitting.

outer casing is of polished brass, easily detachable. It is claimed that by obviating the necessity of wires in the cluster, the cost of the installation is considerably reduced, both for ceiling and pendant forms. In fig. 66 we show a cluster for fixing to ceiling block. Fig. 67 represents one of the firm's arc burst clusters, with polished brass stem, reflector and shade carrier, which are recommended particularly for art galleries, restaurants, and public buildings. These wireless clusters are scientifically arranged to radiate

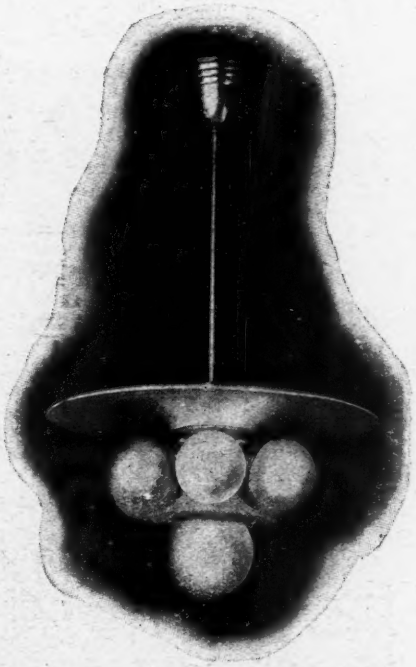


Fig. 67.—An Arc Burst Cluster with Stem.

and distribute perfectly all available light. They are to be seen on the stand of the Lister Electric Manufacturing Co., at the Olympia Exhibition. Messrs. Generators, Ltd., are putting these fittings on the market, adapted for lamps with bayonet caps, in the course of a few weeks. They will be arranged for either series or parallel burning, also so that any number of lamps may be switched on or off in the same cluster.

New Flame Arc Lamps.

The new type of flame arc lamp (fig. 68), at present being manufactured by the Electrical Co., Ltd., is designed for use with the specially prepared flame carbons which emit a soft yellow light of very high illuminating power. The makers claim that by the elimination of the magnet for maintaining the arc great steadiness and efficiency are obtained. The feeds on both the alternating and the continuous types are designed to ensure a constant feeding voltage with a variation of not more than 2 per cent. in current strength. A new design of lantern has been brought out specially suitable for indoor lighting, and this as well as any of the lamps is supplied black or gold or copper finish. It is claimed that the

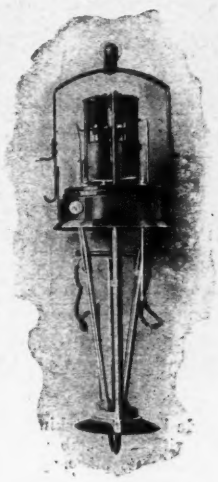


Fig. 68.—New Type of Flame Arc Lamp.

Fig. 69.—The Rignon Lamp.

efficiency of these arcs is very high, and that no less than 6,000 c.p. is obtained. The light obtained from the alternating lamp is of the same efficiency as the continuous current lamp, when the power factor of the lamp (·8) is taken into account. In street lighting this lamp is being very largely adopted on account of the above reasons as well as of the high penetrating effect of the lamps in fogs. A new type of miniature arc—the Rignon lamp—shown in fig. 69, has been recently placed on the market. It is supplied with a dead black or aluminium finish, and with a shade either above or at the back of the arc for shop lighting. The current consumption is only 2 amps. on 100 v. and 200 c.p. is obtained. These lamps being differentially wound avoid all defects of lamps which are only series or shunt wound, and will run in series with excellent results.

Self-Closing Fan.

Messrs. Mestern & Co., Nachf., of S.O. 26, Oranienstr. 6, Berlin, have devised an automatically closing flap for fans which deliver into the external air; as shown in fig. 70, the flaps open when

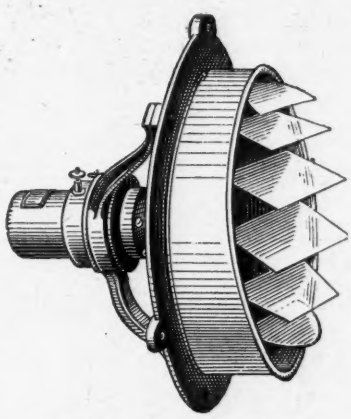


Fig. 70.—Self-closing Fan.

the fan is set in motion, and close when it stops. Thus a back draught, blowing rain over the motor, or driving the fan backwards and spoiling the brushes, is prevented. The firm has also introduced a self-acting water-spray ventilating and humidifying apparatus.

Interchangeable Junction Boxes.

Mr. William Sevenoaks, of St. Pancras Goods Station, Midland Railway, N.W., is placing before the trade a new patent interchangeable junction box (fig. 71) for conduit installation work. It is sometimes difficult to obtain boxes for the sizes required ready in stock, and it is primarily to meet this difficulty that this one has been introduced. The lid on the smaller size is fixed by one screw, yet in such a way as to make it just as rigid as if fitted with four screws; moreover, the lid is sunk completely into the box, which gives it a neat and practically watertight finish, and lifts off when the screw is taken out. Lids on larger bodies are fixed in the same way, but have four screws. The boxes are usually supplied

with a blank disk in each hole; this is practically the same as a solid box, which, with the use of a screwdriver only, can be immediately converted into a box taking any size of conduit (either screwed

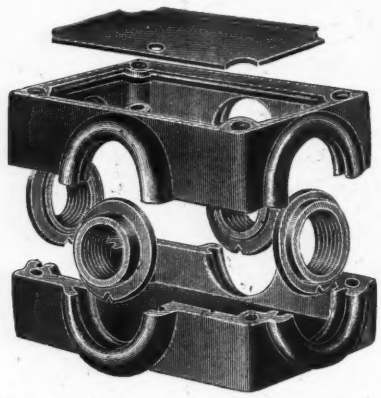


Fig. 71.—Interchangeable Junction Box.

or plain). Any alteration can be made by simply taking out the four corner screws, removing the blank with the thumb and finger, and dropping the screwed or plain disk into its place, as required. No tools other than a screwdriver are needed. The boxes will only fit one way, so that a mistake cannot be made. If it is necessary to make an alteration or extension at any time, the workman has only to take out a blank disk, and drop the necessary screwed or

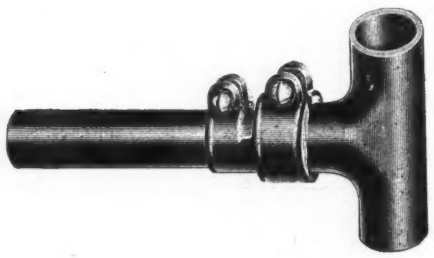


Fig. 72.—Grip Fitting and Reducing Socket.

plain disk into its place. To reduce, it is only necessary to take out the large disk and drop in a smaller one, therefore no reducing sockets are required. When fitting up an installation, it is rather awkward to screw a 13-ft. length of tube into a fitting; it is claimed that with this box it is not necessary to do so, as the disk may be run on to the tube, and then dropped into its place. The principle is easily understood from the accompanying illustration.

Another novelty of Mr. Sevenoaks's is the grip fitting and reducing socket shown in fig. 72. When this is employed, screwed fittings can be dispensed with, ordinary bored fittings being used. It is unnecessary to go to the expense of the next size of fitting, for a ⅝-in. plain fitting can be used with a ⅝-in. plain tube.

Mr. Sevenoaks is also supplying steel conduits, and numerous fittings for use in connection therewith, including counterweight fittings, tumbler switches, watertight mill fittings, knife switches, pipe cutters, and various sundries.

Aluminium Reflectors.

Mr. G. R. Sanderson, of 28, Station Road, Workington, is placing on the market a new and cheap reflector for incandescent lamps, which we show in fig. 73. It is called "The Morse Ideal"

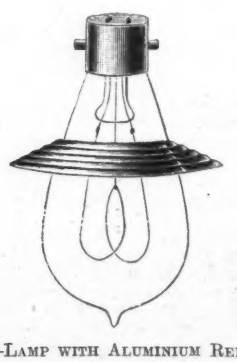


Fig. 73.—Lamp with Aluminium Reflector.

aluminium reflector, and is for use with 8, 16 and 32 c.p. lamps. The claims set up for it are:—Its low cost; it requires no holder, and allows the upper part of the room to be lighted; and it als

reflects considerably more light downward than the lamp does without it. It is claimed to be specially suitable for mills, factories and showrooms.

New Cord Grip.

Scholes's patent cord grip for electric light pendants is intended to prevent the possibility of fire being caused by the short-circuiting and fusing of flexible wires in the lampholder, an occurrence which sometimes results in fire running up the wire. As will be seen from

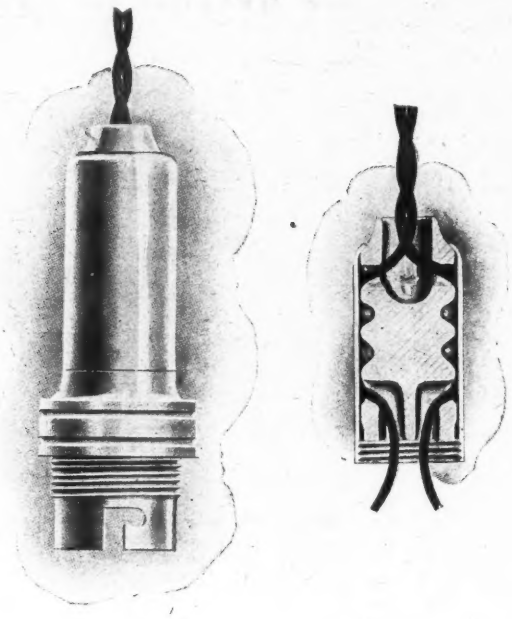


Fig. 74. Fig. 75.
Scholes's Patent Cord Grip.

fig. 75, the flexible wires in this device take separate paths round the porcelain, and a perfect grip is obtained without pinching or damaging the insulation of the flexible wire. It is supplied either to fit on existing holders, or with lampholder complete, and is in the hands of Messrs. Samuel Gratrix, Jun. & Bro., Ltd., of Quay Street, Deansgate, Manchester.

Art Fittings.

Messrs. C. J. Thursfield & Co., of Cecil Works, Clement Street Parade, Birmingham, are just now devoting considerable attention to the production of electric light fittings in the old style, Adam's

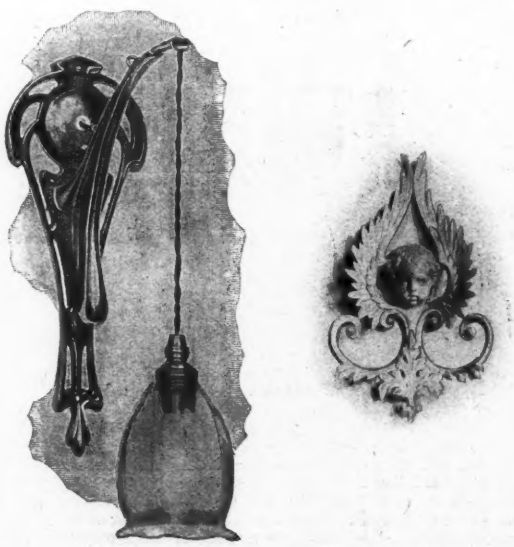


Fig. 76. Fig. 77.

period, namely, fine cast work. In fig. 77 we show part of such a fitting, representing some very fine modelling. In fig. 76 we illustrate another style of fitting in cast work, and we note that a demand seems to be growing for fittings of this description, in preference to the hand-wrought work which has been so much in vogue during recent years.

Messrs. Thursfield wish the trade to take note that they have taken a lease of a suite of handsome showrooms, situated at 21A, Berners Street, Oxford Street, London, W. This will be more accessible than the present showroom in Hatton Garden. They hope to get into the new premises in the course of about three weeks, after which the trade is invited to inspect the rooms.

(To be continued.)

THE LABOUR DISPUTE IN THE BERLIN ELECTRICAL INDUSTRY.

The labour dispute in the principal centre of the electrical engineering industry in Germany has happened at a time when trade is exceptionally brisk. Almost month by month the degree of employment this year has increased with the result of there being a material improvement over the development which began in the course of 1904. The flow of orders both for inland and export had reached an extent comparable to those experienced in the last period of prosperity; but whereas, in the latter years, the work mainly concerned electric tramways and central stations, the home progress this year has been in the large contracts placed by the coal and iron producers for the application of electric power, and also on behalf of the agricultural industry.

Export orders for the construction of tramways and lighting stations have also been fairly numerous, and in anticipation of this development the two leading companies extended their branches abroad in 1904. The amount of work on hand in May in regard to the production of dynamos and motors, transformers and accumulators, rendered it necessary to increase the number of workmen, and the demand for labour in the following month was also brisk. As, however, the supply was scarcely adequate for the purpose, it was found essential in July to work night shifts and overtime at various works.

The demand for workers in the Berlin cable manufacturing branch became so great in July that higher wages were offered and granted in order to secure the necessary labour, while in the succeeding month a considerable improvement took place in the department for insulating materials. In these circumstances it is little wonder that the export trade has shown a marked advance in so far as concerns the period of the year preceding the outbreak of the present conflict. This is illustrated by the following figures, which give in tons the exports in the first eight months of the three years mentioned:—

Eight months' exports.	1903. Tons.	1904. Tons.	1905. Tons.
Electrical machinery	8,580	8,583	8,848
Accumulators	1,616	1,768	1,987
Cables	17,152	13,786	21,909
Telegraph and telephone apparatus, &c.	307	413	425
Total	27,655	24,550	33,169

The number of men and women engaged in the electrical trade in Berlin is approximately 50,000. The present dispute commenced about the middle of September, when nearly 500 men employed at the works of the Siemens & Halske Co., and at those of the Allgemeine Electricity Co., went on strike in consequence of the refusal to grant an increase in wages. It appears that slight disputes have occurred, at frequent intervals during the past year and a half, owing to demands for higher wages and a shorter working day, and the requests to this effect have been accompanied by threats on the part of the men to leave work unless concessions were made. The employers believe that the strike had been planned for a long time past, and the cessation of work by the 500 men represents the last link in the chain of trouble which has overhung the industry for many months. When these men went on strike there was talk of bringing out in support of them all the workmen in Berlin. Not only were the electrical works to be paralysed, but the operations of the Berlin supply company—the Berlin Electricity Works Co.—were to be stopped, and the supply of light from its six generating stations was to cease; public and private lighting was to be at an end; there was to be no power for working the 300 miles of electric tramways, the State electric railways, or for the lighting of the railway stations. In a word, Berlin at night was to be a city of darkness and gloom. But whilst these terrors threatened to overshadow the capital, the employers made a bold move which took the workmen completely by surprise; they dismissed about 8,000 workers from the Werner Works of the Siemens & Halske Co, at Nonnendamm, and from the Upper Spree Cable Works of the Allgemeine Co. at Oberschonweide, the Siemens-Schuckert Works Co. also agreeing to act in concert with the other two companies.

The dispute first broke out at the Werner Works, where the screw turners demanded an increase of 15 per cent. in piece work, but as only 5 per cent. was offered, 180 men went on strike; while the packers or warehousemen at the Upper Spree cable factory, to the number of 250, also left their employment owing to a request for higher wages being refused. As the companies had long been tired of the unceasing demands put forward on behalf of the workmen, which they declared to be economically impossible, they decided upon the lock-out as already mentioned. The men were then given an opportunity of returning to work on the terms prevailing before the outbreak of the strike, and on condition that their demands were withdrawn, but as they declined to avail themselves of it, the three companies at the end of September extended the lock-out by closing six of the works, and increasing the number of persons idle to 40,000. In the meantime, attempts were made to bring about a settlement between the employers and workmen by the holding of conferences, but the companies declined to agree to the men's request for the dispute to be referred to the decision of the Government Conciliation Board. While these negotiations were proceeding, many of the stokers and engine tenders at the generating stations of the Berlin Electricity Works Co. joined the strike movement. This resulted in a reduction in the amount of energy available, but practically the only effect noticed was a reduction in the tramway services of the Grand Berlin Tramway Co. for two or three days, as fresh workers were obtained and the services of the engineers and officials of the three electrical engineering companies were at once requisitioned for the rendering of assistance, together with those of 50 of the city firemen.

The complaints made in certain of the Berlin newspapers of the rates of wages paid by the electrical companies have induced the Siemens & Halske Co. to issue figures relating to actual payments made on piecework to different classes of workpeople in 1897 and in June of the present year. The statistics may be set out as follows:—

	Average earnings per hour. 1897.	June, 1905.
Turners ...	... 66 pfennigs	71·3 pfennigs
Screw turners ...	... 59 ,,	63·9 ,,
Mechanics ...	... 60 ,,	65·3 ,,
Toolmakers ...	... 66 ,,	73·5 ,,
Workwomen ...	... 27 ,,	32·0 ,,

	Daily earnings in summer of 1905.	s. d.
Turners ...	... 6·40 marks =	6 4·8
Screw turners ...	... 5·20 ,, =	5 2·4
Mechanics ...	... 5·50 ,, =	5 5·0
Toolmakers ...	... 6·15 ,, =	6 1·8
Workwomen ...	... 2·40 ,, =	2 4·8

The Siemens & Halske Co. further point out that at the same works in a period of four weeks in the past summer the turners earned £7 19s. 6d., the screw turners £6 10s. 6d., the mechanics £6 17s., the tool makers £7 13s., and the workwomen £3 0s. 6d. each, and they conclude that the wages movement is due to the political activity of the trade unions.

At the present time there are about 45,000 workpeople on strike and locked out. This number is to be increased to 65,000 on October 14th, unless the dispute is settled, by the determination of the Association of Berlin Metal Manufacturers to close their works on that day in order to support the electrical engineering firms. If this decision is carried into effect it will involve 20,000 workers who were engaged in a dispute with their employers as recently as a year or so ago. The metal workers' trade union, to which the striking turners belong, has a fund of £50,000 available for use, and it provides strike pay ranging from 9s. to 18s. per week. As the electrical workers are short of strike funds and the collections made in their aid are not very productive, it seems probable that the strike will soon collapse and the workmen return to their employment on the old terms. The employers, it would appear, are determined by their drastic action in locking out so many workers to settle once and for all the cause of the many disputes and demands which have taken place in the past year and a half. What they desire is peace in the shops—peace of a lasting character—and not constant threats of strikes when demands are refused; and being wealthy companies they are prepared to contest the matter until the end. On the whole the men have conducted themselves during the dispute in a peaceful manner, and the impulse of the moment may induce them at any time to agree to return to work chastened by the unexpected difficulties which arose from the decisive action of the employers. But the men have entirely failed to bring about the disorganisation of trade in Berlin as was threatened, and they have been equally unsuccessful in regard to the working of the tramways, electric railways, the lighting and the supply of power to the hundreds of manufacturing establishments in the German capital.

EFFICIENCY OF STEAM GENERATING APPARATUS.

The author of this paper, presented to the June meeting of the American Society of Mechanical Engineers, evidently has a poor opinion of boiler-makers who consider they have done their duty when they have supplied a vessel that will not leak and will not burst too soon. Such a vessel is a boiler, and there their interest ends.

The efficiency of a boiler is a constant for any particular boiler, because of its shape and arrangement. Boiler efficiency is a combination of other items. Furnace efficiency may be exactly measured by the composition of the gases leaving it. Instruments are available which will automatically record furnace gas analysis, as far as the most important constituent is concerned. Within about five years nearly every engineering college of the United States has added some CO_2 recorder to its equipment. They have been largely discontinued, we are given to understand, by lack of ability to appreciate them, not because of their own faults. This need be a matter of no surprise, for in this country we had a long start of the United States, and we are no further advanced.

Mr. Bement's special point is the path of gases from furnace to chimney. If after even perfect combustion the gases are provided with too roomy a path to the chimney, they will not search out every unit of heating surface, and serious loss of efficiency will result. The natural path of the gases is the shortest, and they will travel by the short circuit unless compelled to do otherwise.

Several useful points are elaborated, notably that low initial temperature is accompanied by high final temperature of gases, because the heat-absorbing efficiency is reduced first by the reduced temperature head, and secondly, by the reduced time of contact. The author considers that, in the case of the two boilers he illustrates, in one of which there are two extra baffles, so as to compel the gases to fill the tube voids completely, there will be a difference of 10 per cent. in favour of the better arrangement when the boilers are served with a good fire. As the fire conditions become poorer the difference increases. If engineers would watch this point they might often secure better results. The paper bears more particularly on boilers of water-tube type, which have the baffles arranged so that the gases travel, to some extent, parallel with the axes of the tubes. Without the two additional baffles, however, the path of the gases is a diagonal from corner to corner.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to the Editors for insertion in this column should be written on one side of the paper. Free use of fictitious names, &c., may be made. Answers are furnished by a duly qualified lawyer, but the Editors cannot undertake to be responsible for the accuracy of the views which he may express.*]

"F. J." writes:—"A client of mine wishes me to install a gas engine and dynamo in the basement of his shop (retail shop selling fancy goods), and I should like to know (1) whether when the plant is running the basement will be considered a workshop under the Factory Act.

(2) Is there any Act which specifies that when an engine is fixed in a room, a certain distance as clearance must be allowed between it and the wall. I thought of fixing the engine within 1 ft. 6 in. of the wall, as room is very limited.

(3) Are there any general conditions to be observed when installing machinery? If so, where could I obtain a copy of these?"

*** There does not appear to be any case in the law reports which throws light on the question whether the electric lighting installation referred to by "F. J." does or does not come within the purview of the Factory Acts.

The following are included in the definition of the term "factory," as used in the Factory Act, 1901:—"Electrical stations," that is to say, any premises or that part of any premises in which electrical energy is generated or transformed for the purpose of supply by way of trade, or for the lighting of any street, public place or public building, or of any hotel, or of any railway, mine or other industrial undertaking.

The question then is: Is a retail shop an "industrial undertaking?" Assuming—and it is perhaps safer to assume—that the law will so regard it, "F. J." should be prepared to comply with the provisions of the Factory Act, 1901. He should, therefore, take care that the engine room is properly ventilated, and that the fly-wheel and all moving parts of the machinery are fenced in accordance with Sec. 10 of the Act of 1901.

With regard to (2) we are not aware that a fly-wheel must be placed at any particular distance from the wall. As to (3) we do not know of any special regulations relating to the instalment of machinery.

NEW PATENTS APPLIED FOR.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

19,342. "Improved magnetic apparatus for advertising purposes." G. C. Lundberg. September 25th.

19,345. "Improvements in holders and connections for electric incandescent lamps." J. R. Quain. September 25th.

19,355. "Improved means for automatically operating gas or other valves or electric switches at predetermined times." A. Hare. September 25th.

19,368. "Improvements in brush-holders for dynamo-electric machinery." J. H. St. Hill Mawdsley. September 25th. (Complete.)

19,372. "Electrically operated electro-magnetic valves." W. C. Northcott, E. C. Townsend and E. C. Hoegerstaldt. September 25th. (Complete.)

19,379. "Process for the production of incandescent filaments for electric incandescence lamps." The Deutsche Gasglühlicht Akt.-Ges. (Auer Ges.) (Date applied for under Patents Act, 1901, January 17th, 1905, being date of application in Germany.) September 25th. (Complete.)

19,425. "Improvements in and relating to electro-capillary apparatus." E. Oldenbourg. September 26th.

19,447. "A new or improved connector for electric conductors." E. W. Hill. September 26th.

19,483. "Improvements in hydraulic lifts electrically operated." E. M. T. Boddom. September 26th.

19,495. "Improvements in electric radiators or heaters." S. Cowper-Coles. September 27th.

19,504. "Improvement in trolley pole controllers." A. L. Prentiss. September 27th.

19,545. "Improvements in and connected with electric meters." J. M. Tourtel. September 27th.

19,551. "Improvements in electrical time switches." E. Du Bois. September 27th.

19,553. "Improvements relating to telephones especially adapted for the use of partially deaf persons." C. Nathan and J. J. L. Newland. September 27th.

19,554. "Improvements in indicating or checking devices for use in connection with telephones." H. B. Skeldon and F. M. Elliott. September 27th.

19,561. "Improvements in electric arc lamps." W. J. Davy. September 27th.

19,568. "Improvements in electrically controlled semaphore signals for railways." F. B. Holt and A. Wallis. September 28th.

19,603. "Improvements in and relating to automatic electrical circuit-breakers." Crompton & Co., Ltd., and R. C. Harris. September 28th.

19,616. "Improvements in electric batteries." G. Schaull. September 28th.

19,631. "Improvements in primary electric batteries." M. Christensen. September 28th.

19,633. "Improvements relating to sockets for holding electric lamps and the like." F. Millington. September 28th.

19,638. "Process for the electrolytic production of copper." J. A. W. Borchers, F. E. Gunther and P. R. Frankf. (Date applied for under Patents Act, 1901, October 4th, 1904, being date of application in Germany.) September 28th. (Complete.)

19,657. "Electric transformer controller." G. T. H. De Witt, C. Conkling and J. E. Winn. September 29th. (Complete.)

19,667. "A protector for preventing short-circuiting by water in spark plug of explosion engines and the like." C. A. Pooley. September 29th.

19,680. "An improved form and method for holding and insulating flexible cords and wires in connection with electric lampholders and other electric appliances." F. MacCallum. September 29th.

19,684. "Improved means for attaching and detaching the reflectors of electric lights." W. Bell. September 29th.

19,698. "Improvements in electric lighting apparatus for shop window lighting and the like." H. L. Vickery. September 29th.

19,706. "Improved replacement action for intercommunication telephones." W. J. Roach. September 29th.

19,712. "Improvements in or relating to electric arc lamps." A. E. Blondel. September 29th. (Complete.)

19,719. "Improvements in reflectors for electric arc lamps." M. V. Ely and E. R. Grote. September 29th. (Complete.)

19,746. "Improvements in or connected with trolley heads for electric tramcars or the like." F. Hewer. September 29th.

19,753. "Improvements in insulated belts for electric tramway systems and the like." J. Haydock and T. S. Jones. September 30th. (Complete.)

19,816. "Improvements in or relating to electrical fuse or cut-out boxes." R. Rumney and H. H. Bishop. September 30th.

19,819. "Improved device for strengthening telephone currents." F. Oprendek. September 30th. (Complete.)

19,823. "Improvements in or connected with means for supporting and insulating overhead conductors for electric tramways or railways." F. Hewer. September 30th.

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).

1904.

Means and Appliances for Operating Electrolytic Cells. J. Hargreaves 18,937. September 2nd.

Electric Motor Control Systems. British Thomson-Houston Co., Ltd. (General Electric Co.) 19,574. September 10th.

Electric-Magnetic Mechanism, Particularly Applicable to Railway Signalling Apparatus. British Thomson-Houston Co., Ltd. (General Electric Co.) 19,889. September 15th.

Hangers and Ears for Electric Conductor Wires. J. Heap, J. Bailey, H. Heap, A. Richardson, R. Billington, J. Haydock, T. S. Jones and T. Brierley. 20,413. September 22nd.

Dynamo-Electric Machines. British Thomson-Houston Co., Ltd. (General Electric Co.) 20,552. September 23rd.

Electric Meters and Measuring Instruments. British Thomson-Houston Co., Ltd. (General Electric Co.) 20,609. September 24th.

Electric Arc Lamps. O. Gross. 21,242. October 4th.

Apparatus for Wireless Telegraphy. Marconi's Wireless Telegraph Co., Ltd., E. Berry and H. A. E. Ewen. 21,640.

Safety Devices in Connection with Radio Telegraphic Transmission Circuits. Marconi's Wireless Telegraph Co., Ltd., E. Berry and H. A. E. Ewen. 21,641. October 8th.

Rail Joints and Electrical Bonds Connected Therewith. R. H. Radford. 21,722. October 10th.

Swivelling Coupling for Electric Cables. E. B. Phillips and T. C. Parkin. 21,729. October 10th.

Electric Arc Lamps. F. M. Lewis. 21,892. October 11th.

Electric Telegraphs. Siemens Bros. & Co., Ltd., and G. S. Grimston. 21,895. October 11th.

Electrical Measuring Instruments. Siemens Bros. & Co., Ltd., and E. A. Holmes. 27,246. December 14th.

Electro-Mechanical Apparatus for Automatically Operating the Rail and Electrical Conductor Points on Electric Tramways and Railways from the Tram or Train. G. D. A. Parr. 18,060. August 20th.

Controllers or Cut-Outs for Electric Circuits. C. C. Garrard. 18,196. August 22nd.

Parallel Running of Dynamo Machines. Hon. C. A. Parsons and G. G. Stoney. 18,255. August 23rd.

Controllers for Electrically-operated Capstans and the like. W. H. Scott. 18,298. August 23rd.

Means for Controlling Electric Circuit-Breakers. British Thomson-Houston Co., Ltd. (General Electric Co.) 19,572. September 10th.

Electric Arc Lamps. W. J. Davy. 20,019. September 16th.

Electric Ignition for Internal Combustion Engines, and Apparatus therefor. B. Kennedy. 21,622. October 8th.

Safety Devices for the Trolley Poles of Electric Cars. James Hawley, Ltd., and D. R. W. Hardman. 24,290. October 17th.

Sparking Plugs for Explosion Engines. A. J. Boult. (Macquaire.) 22,637. October 20th.

Electric Arc Lamps. Jandus Arc Lamp and Electric Co., Ltd., and A. D. Jones. 22,838. October 24th.

Electro-Medical Appliances. P. Wenigman. 25,979. November 29th.

Electric System of Driving Vehicles in an Arena or Course. E. E. Lehwess. 27,605. December 17th.

Electric Alternating Current Motors. Siemens Bros. & Co., Ltd. (Siemens-Schuckert Werke G.m.b.H.) 29,435 and 29,436. December 31st.

Manufacture of Electrodes for Electric Accumulators. Bruno. 11,920. May 25th.

Means for Maintaining in Juxtaposition like Poles of Relatively Movable Magnets or Magnet Systems. (Rights under Patents, &c., Act 1901 not granted.) Gercke. 16,760. July 29th.

Thermal Connections for Electrical Wires. McDermott. 18,926. September 2nd.